FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 98
No. 2004
Registered at the G.P.O. as a Newspaper

JANUARY 27, 1955
Offices: John Adam House, John Adam St., London, W.C.2

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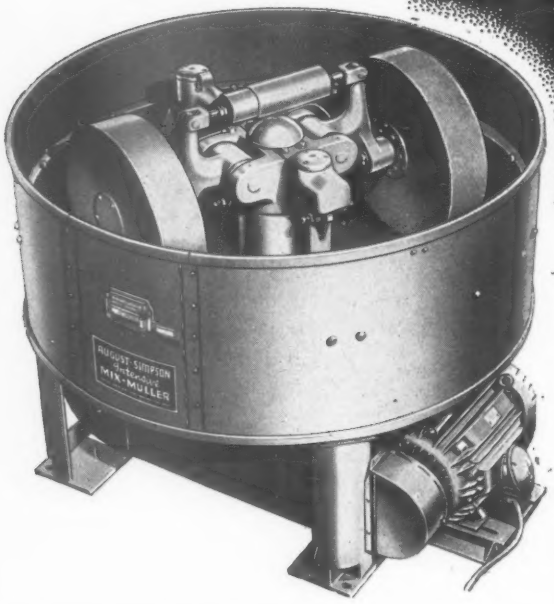

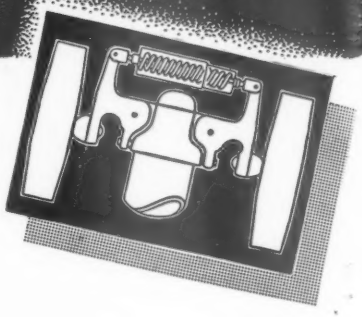

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Established 1902

Vol. 98 Thursday, January 27, 1955 No. 2004

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Cleaning of Castings, by L. B. Childe, BSc., AMIMechE:
After dealing very briefly with other methods, the Author concentrates on abrasive cleaning. History and terminology are dealt with as a prelude to a systematic review of available methods and equipment under the main headings of plants using air-borne or mechanically-impelled abrasive. Hydroblast and liquid blasting plants are surveyed. A final section covers power requirements, abrasives, miscellaneous equipment, legal requirements and dust extraction 87

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Corrosion in the Home

Last week, we visited an exhibition organized by the Corrosion Group of the Society of Chemical Industry at Battersea Polytechnic which broadly covered the subject of "Corrosion Prevention in the Home." It is too late to suggest that the exhibition should be visited by readers as it was only open for two days. Yet this would have been desirable, as such a variety of castings enter the home. One section of the show was devoted to modern materials which reduce corrosion problems to a minimum, such as stainless steel, Monel metal and vitreous enamelling. In this section, there was an exhibit showing how, by the use of sodium silicate as an inhibitor, rust deposits could be prevented in hot-water radiators and the like. Some stress was rightly given to cathodic protection, and the foundry industry needs to learn and apply this obviously useful system.

From the foundry angle, perhaps the most interesting stand was that of the Building Research Station. Here, we were first attracted to a badly-cracked 6-in. cast-iron fall-pipe and were told that the failure was due to the expansion of the very heavy rust deposit. This, it was stated, had been proved by sawing out a small section, cleaning off the deposit and finding that the gap at the crack had closed. The heaviness of the rust deposit was due to the pipe being installed for the draining of a copper-roofed building, and no such action is to be expected with slate or tiled roofs. Lead fall-pipes, too, suffer when installed in association with copper roofs, but have a very long life under other conditions. Next, we questioned a young scientist about the short life given by aluminium flushing systems exhibited, and the answer was unequivocal—"Aluminium alloys should not be used in plumbing systems."

The great lesson to be learned from this exhibition is that designers and manufacturers of goods for domestic use should familiarize themselves with the mechanism of corrosion. This knowledge would have prevented—as was shown by numerous examples—the use of two quite dissimilar metals contiguously in water-carrying equipment. Corrosion was often so serious that the original shape of the components was quite unrecognizable. Another lesson is that corrosion problems can be minimized by the use of the many new materials now available. This show gained from being quite small—most exhibitions are so big as to preclude a detailed examination of a representative number of the exhibits. The display is of the type which could very profitably "go on tour," because there must be a very large number of makers of equipment for the home who need to be given visual evidence of the minor disasters which can come about through lack of knowledge of the physics and chemistry of corrosion.

Shell-moulding Advice

Over 60 foundrymen, including one from Australia, attended the open meeting in London last week to discuss shell moulding, organized by the Association of Bronze and Brass Founders. The meeting was held at the Clarendon Restaurant, Hammersmith, under the auspices of the Advisory Service Scheme for non-ferrous founders, jointly undertaken by the Association of Bronze and Brass Founders and the British Non-Ferrous Metals Research Association; Mr. W. R. Buxton took the chair, and Mr. A. F. Raynor, president of the ABBF, also attended.

The lecturer was Mr. J. L. Rice, BMet., using as a basis his "Interim Report on the Shell Moulding Process."* This Report he prepared after a several months' survey of shell-moulding in this country, his services having been loaned to the Advisory Service by the BNFMRA. Mr. Rice illustrated his remarks by a number of slides and considerable discussion† followed, particularly on such topics as "to back or not to back" shell-moulds; prospects of sand reclamation; zirconia to replace silica sand; the relative merits of dump-box and pressure moulding, and alternative pattern materials. At the conclusion it was stressed that Mr. Rice's remarks were interim findings and that the work would be continued.

Preceding the shell-moulding meeting, there was an afternoon meeting of London-area members of the ABBF, also in the Clarendon Restaurant. Here, the subjects included consideration of the Advisory Service; a report on the industry *vis-à-vis* safety, health and welfare; report of the scrap advisory committee; rating of industrial premises; fuel prices; specification revision; research and publicity for the industry and a brief discussion of the metal market.

* This Report is now virtually out of print, but a reprinting is being arranged. Requests for copies should be addressed to the Secretaries, Association of Bronze and Brass Founders, 69, Harborne Road, Edgbaston, Birmingham, 15. (Price, 5s. to non-members of the Association.)

† It is hoped shortly to report the discussion in the JOURNAL.

Sheepbridge Appointments

Less than a year after taking up a new appointment as general manager, Mr. G. E. H. Hall, AMIProdE, has been appointed a director of Sheepbridge Stokes, Limited, and of British Van der Horst, Limited, Chesterfield. Mr. Hall was formerly works manager for Light Production, Limited, of Slough. Mr. R. Gore, AMIMechE, AMIProdE, is now general manager of the engineering division of Sheepbridge Equipment, Limited. Mr. Gore has had 18 years' experience with Vauxhall Motors, Luton, and left Rolls-Royce, Limited, to join Sheepbridge Engineering, Limited, as group methods engineer in 1953. Mr. C. Hand has been appointed general manager of the foundry division of Sheepbridge Equipment, Limited. Mr. J. R. Jonkins, also formerly with Rolls-Royce, Limited, has been appointed methods engineer for the southern group of Sheepbridge Companies, comprising Automotive Engineering, Limited, Hardinge Machine Tools, Limited, Light Production, Limited, Clews Petersen, Limited, and Sheepbridge Engine Repairs, Limited.

BRITISH TRANSPORT COMMISSION announce that a contract has been placed with the Metropolitan-Cammell Carriage & Wagon Company, Limited, for 600 30-ton bogie bolster wagons.

The Late Mr. Richard Spriggs

In last week's issue of the JOURNAL, the death of Mr. Richard Spriggs was briefly recorded. The following appreciation has now been received from his firm:—

A native of Leicester, Mr. Spriggs began his engineering career in that city with Vipon & Headley, Limited. He joined Herbert Morris, Limited, in March, 1906, and he had been keenly looking forward to completing his half-century with the firm (his death occurred in his 49th year of service). During his career he had been in charge of practically every department of the Herbert Morris organization and for a time was in charge of the French factory in Paris. Latterly he had specialized and developed the foundry-equipment section, which was an entirely new departure for the company. In the course of the last war, he crossed the Atlantic (at a time when the submarine menace was at its height) to discuss this department with the American firm from which the Herbert Morris organization holds manufacturing licences.

About 30 years ago Mr. Spriggs was particularly well known in the town's public life and served as hon. secretary of the Loughborough War Memorial Committee, which built the world-famous carillon in Queen's Park, and of the Loughborough General Hospital Extensions Committee, which raised large sums of money to build the extensions to the hospital and other projects. In both these great tasks he co-operated closely with the late Mr. W. H. Purnell, chairman of Herbert Morris, Limited, whose fine leadership did so much to bring them about. Mr. Spriggs, as a representative of the Old Loughborough Civic Association, a lively, independent, non-political body of men working for the welfare of the borough, was elected a town councillor for Storer Ward in 1922 and served for three years in this capacity. He was formerly a keen golfer and was a member of the Longcliffe Golf Club for many years. During his playing career he was honoured with the captaincy of the club and on his retirement from the game was made an honorary life member. He was also an honorary member of the Quorn Country Club, of whose committee he was chairman for some years and also a director, and he was a member of the Loughborough Club.

International Congress Fund

The Council of the Institute of British Foundrymen acknowledges with appreciation the following subscriptions received for the special fund which is being raised in connection with the International Foundry Congress to be held in London next June. It should be noted that Mr. N. P. Newman, J.P., of Newman, Hender & Company, Limited, Woodchester, Stroud, Glos., is hon. treasurer of the congress fund and he will be very pleased to receive subscriptions:—

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Cleaning of Castings*

By L. B. Childe, BSc, AMIMechE.

If it be conceded that "dirt is matter in the wrong place," the cleaning of castings must comprise the removal of unwanted matter from the surfaces of the castings; this "matter" will in general be sand or other mould material, mixed with oil, coal-dust or other additives and all perhaps burned on, metal oxide in the form of scale and even surface roughness, together with "flash" and other excrescences, and maybe sprigs and wire which have been used to strengthen the mould or core. So far as the Author is aware, no miracle-working proprietary chemicals or compounds have so far been produced to achieve the desired result, such as are much advertised in the field of domestic economy, so that cleaning has to be done by hand or mechanical agency. As to the former, wire brushing and rubbing with emery block, filing, and so on, whilst still largely practised, are effective only so far as precious man-hours are squandered in the process; and since in more senses than one they only scratch the surface of the problem it is not proposed to devote any space to consideration of such methods.

Mechanical means of cleaning castings may be listed under three headings:—(*a*) Grinding; (*b*) tumbling; and (*c*) abrasive blasting and "shotting" (a word defined later in the Paper).

Grinding may be dismissed in a few words, since its field of application is limited and the technique simple and generally well understood. The limited applicability is due to the inaccessibility of the parts of all but the simplest castings to grinding wheels of reasonable size, the difficulty of mechanizing any grinding process and the dust hazard raised. An advantage is that "flash" and roughness difficult to deal with by other methods can be removed better by grinding than in any other way, and, with care, the dust raised can be satisfactorily controlled.

Tumbling is the simplest mechanical-cleaning method and consists of rotating a batch of parts in a barrel at such a speed that their mutual bumping action, aided sometimes by a quantity of "stars" or "rattlers," batters the sand, etc., from the surfaces of the castings. The process is clearly chiefly suitable for small parts of simple shape, produced in quantity, but is unsatisfactory for fragile parts or those having complicated shapes, cored holes, and so on. It is advisable to remove the worst of the adherent sand, etc., before tumbling, otherwise this may have a cushioning effect on the action. Steps must be taken to render the barrel dust tight or to enclose it in a cabinet, having dust-extraction equipment. Alternatively, the process may be carried out wet—water or certain proprietary liquids, together with mineral chips then being the additives. The barrels are usually of octagonal cross section and sometimes rotate about an axis inclined to the true axis of the barrel, which method seems to give additional vigour to the tumbling action. The equipment is low in first cost and in power requirements, and within its limits the process is useful especially for the small foundry—if a position can be found to instal the plant where noise will not cause complaints.

It is proposed to devote the rest of this Paper to the various processes and types of equipment by which abrasive blasting is carried out, since the adaptability of the method and the results obtained are of a much higher order than those previously mentioned.

Historical

So far as can be ascertained, the original Patent for a sandblasting process was taken out by Tilghman, a Dutchman,† in the 1870's for a process of cleaning by means of a jet of steam carrying sand as the abrasive. Although steam-operated equipment may still be in use—probably for re-sharpening files by the Matthewson process—the advent of reliable air-compressors inevitably suggested the superiority of compressed air as the motive agent and until the 1930's shotblast plant operated by compressed air found increasing application in foundries as well as in other branches of the engineering industry. A rival method of obtaining a high-speed "blast" of abrasive then appeared—the centrifugal or so-called "air-less" machine in which the abrasive is thrown by the blades of a rapidly-rotating runner. Meanwhile, the abrasive sand was giving place to other abrasives, chiefly angular metallic grit, superior on account of its longer life and freedom from the danger of operators using it contracting silicosis. Thus, also, synthetic silica-free "sands" came to be used where metallic abrasive was undesirable. A further variant of the blasting process is that in which the stream of abrasive is carried in a high-pressure jet of liquid (usually water) or in a mist of liquid particles in an air jet.

Terminology

The Author is early in difficulty with terminology; the original term "sandblasting" was self-explanatory, but when metallic abrasive superseded sand, the term "shotblasting" came to be used in place of "sandblasting"; this, however, raised confusion amongst those who knew shot as particles of lead (which has actually been used for this purpose but is really most undesirable). Just when shotblasting had become generally accepted and

* Paper read before the Slough section of the London branch of the Institute of British Foundrymen, Mr. C. J. Williams presiding.

† The Tilghman family is American, having originated, it is thought, from Tilmanstone in Kent.—Editor.

understood the centrifugal means of projecting the abrasive came along and one heard of "airless blasting"—surely a contradiction in terms. "Shotting," a word coined by the Author, seems to cover the process fairly well but what then can be used when non-ferrous abrasives of the carborundum type are used? However, it is proposed to use the terms "shotblast" to cover abrasive blasting by air, and "centrifugal shotting" for the "airless" process.

COMPRESSED-AIR OPERATED TYPES

Compressed-air-operated plants may use a manually-controlled abrasive blast directed from a flexible rubber hose, or may be automatic in operation, the parts being passed through the blast issuing from a fixed or moving nozzle or nozzles. Small parts are occasionally held by hand in the blast from a fixed nozzle, but this arrangement is not commonly used. Some examples of compressed-air-operated plants are given in what follows:—

Manually-controlled Plants

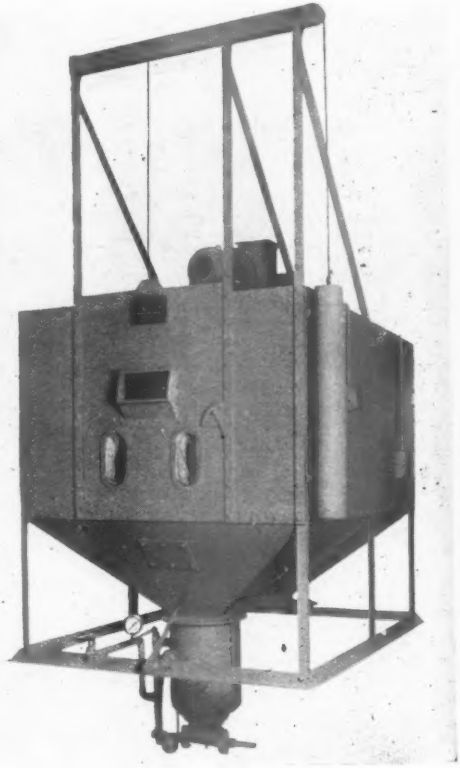
The cabinet type, one example of which is shown in Fig. 1, is probably the most popular type of manual plant and generally comprises a booth large enough to contain one large or many small parts with room to turn the parts over and turn them round by an operator working from outside. The abrasive blast is directed on to the parts by the operator, who puts his arms, suitably clad in rubber gauntlets, into the booth through armholes, and observes the process through a sight glass. Below the booth is a pressure chamber containing a supply of abrasive under air pressure and this feeds the flexible hose through a mixing tube, in which the abrasive is fed into the compressed-air stream. The mixture flows at relatively low speed through the hose to a nozzle. Here the air expands to atmospheric pressure and accelerates to a high velocity, carrying with it the abrasive. The hose may be led into the cabinet at the top, side or front, depending upon the shape and size of the parts under treatment; for small parts, it is sometimes more convenient to move the parts about under a fixed blast.

The walls of the cabinet are usually rubber-lined to withstand the ricochet abrasive, and the floorplates, which must be perforated or slatted to allow the spent abrasive to fall through, should be easily replaceable. A hopper beneath the floorplates collects the spent abrasive and this is periodically re-charged into the pressure chamber through an admission valve which is kept closed during blasting. "On/off" control of the compressed-air supply is by pedal or hand lever (preferably the former so as to leave both hands free) and it must be turned off and the blast allowed to die away (a matter of a few seconds, during which the compressed air in the pressure chamber exhausts itself) before the door is opened for unloading and reloading of parts.

A protected lamp or lamps for illumination of the cabinet, a sight glass through which the operation is observed and a baffled air vent through which air is drawn into the cabinet by the dust extractor (to be mentioned later) are also required.

Cabinets are available in many sizes, the smallest being that of a biscuit tin, with one handhole, in which parts which can conveniently be held in one hand can be treated with a fixed blast. In cabinets above this size, two handholes are always provided, necessitating an enclosure 2 ft. wide or more, and sizes commonly range from 2 ft. cube up to 6 ft. wide by 4 ft. deep by 4 ft. high, the 3-ft. cube model being probably the most popular. There is little point in making cabinets larger than the size mentioned, since an operator can only reach into the cabinet a distance equivalent to the length of his forearm (about 18 in.) and parts which are too big to manipulate in such a cabinet are likely to be too heavy to turn over in it. For awkward jobs, it is a help to mount a turntable, either hand- or power-operated, in the floor of the cabinet, to enable castings to be rotated whilst blasting; they may still have to be turned over to reach all

FIG. 1.—*Shotblast cabinet, with integral dust-arrester.*



surfaces, and care has to be taken in the design of such turntables to prevent abrasive from getting into bearing surfaces.

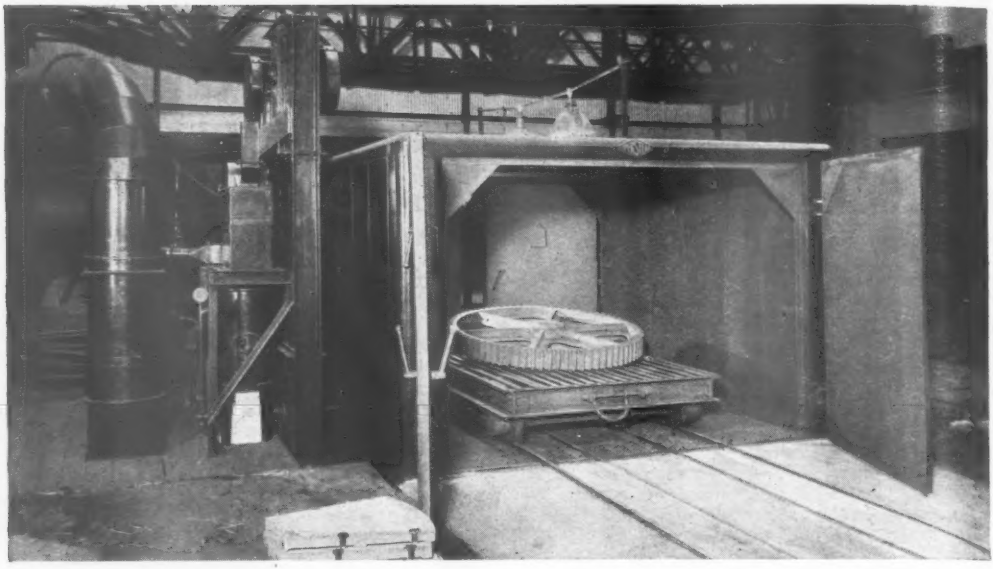
Room Plants.

Room-type plants are the "maids-of-all-work" of the shotblast world and may be thought of as cabinets enlarged to a size where the operator, suitably dressed in protective equipment, works inside instead of directing the blast from outside. The requirements are a room large enough to contain the largest part to be treated, plus space for the operator to get all round it and turn it over. Such plant is referred to as a "maid-of-all-work" since small parts can be treated therein with equal facility, usually many at a time are laid out on the floor or on a collapsible or removable table. Otherwise, the design of the plant follows the same lines as a cabinet—namely, a perforated floor, hopper, pressure chamber, flexible hose and nozzle and dust-extraction equipment.

Large rooms necessitate a deep excavation to house the hopper and pressure chamber. To improve the accessibility of the pressure chamber and obviate the considerable vertical air-lift of the abrasive in the hose, the discharge from the hopper is usually fed to the boot of an elevator which raises the abrasive to a pressure chamber sited at ground level. As a means of reducing the depth of excavation, one or more horizontal conveyors may be used to collect the abrasive below floor level and carry it to the elevator. Conveyors add to the first cost of the plant but may more than save their cost in excavation and installation charges, particularly in wet or rocky subsoils. Instead of the elevator, an air-lift for the abrasive is occasionally incorporated with the dust-extraction system.

Shotblast rooms may be made from about 6 ft. square—the smallest in which an operator can conveniently work and move about, and are normally about 7 ft. high. There is theoretically no upper limit to their size, but in the larger sizes they become very costly both to instal and to run—the latter chiefly because of the large dust-extraction plant which must be provided to maintain a dust-free atmosphere in the room. In the larger sizes, such as that shown in Fig. 2, provision may be made for two or more operators to work, partial screening between the operators being desirable in such cases to prevent one directing his blast towards another; means may also be provided

FIG. 2.—*Large shotblast room for four operators.*
(Courtesy of Ministry of Supply Factory, Leyland.)



(Courtesy of Spencer & Halstead Limited.)

FIG. 3.—*Shotblast room with a bogie to carry the castings.*

to facilitate loading and unloading the room—either a bogie on rails (Fig. 3) or an overhead joist runway with chain-block or electrical hoist—also useful for turning the work over. In such cases, the hoist should be disconnected and run out of the room before blasting, unless it can be housed in a kind of clerestory with flexible rubber flaps to isolate it from ricochet abrasive.

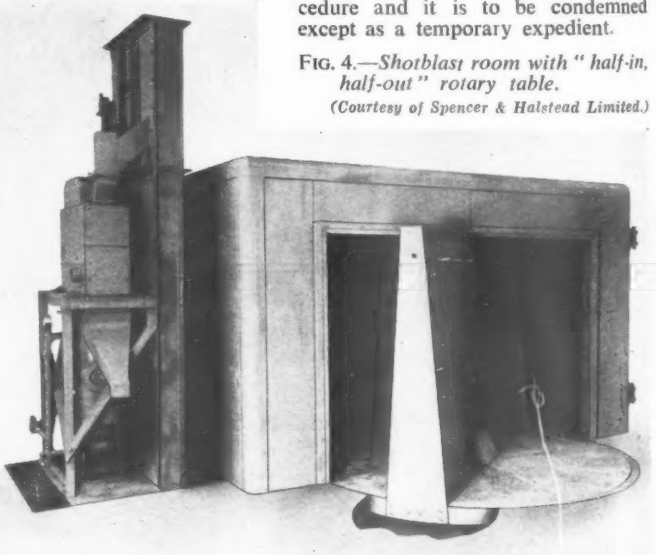
As in the case of cabinets, a turntable may be set in the floor for turning parts round and it then becomes possible to blast part at any rate of the work from outside, treating the room as a large cabinet. However, it may still be necessary for the operator to enter the room to reach, for example, cored surfaces and to touch-up places which, due to his distance away when blasting, are found to have been missed or incompletely cleaned.

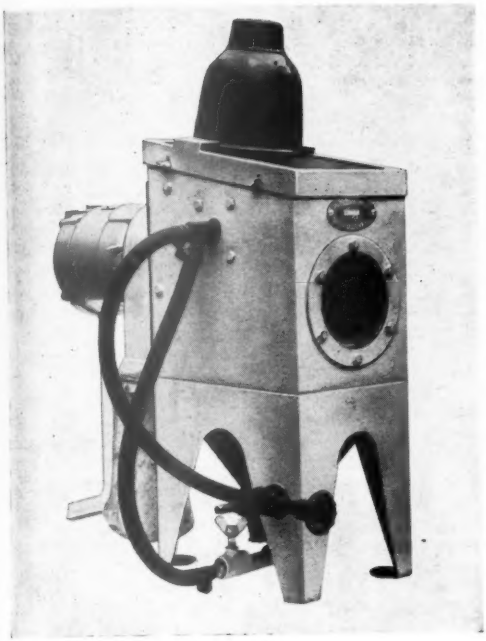
Independent Pressure Chambers.

In the past, a pressure chamber into which abrasive is periodically charged by hand has been used together with a flexible hose, etc., by an operator working either in the open or in a temporary enclosure or in a corner with tarpaulin screens rigged to shut it off to some extent. If such a plant is located in the open, most of the abrasive will inevitably be irrecoverable; if in a temporary enclosure it will be difficult to achieve adequate dust-extraction, though most of the spent abrasive may be recovered by sweeping up. In either case, several of the Factory Regulations are contravened by this procedure and it is to be condemned except as a temporary expedient.

FIG. 4.—*Shotblast room with "half-in, half-out" rotary table.*

(Courtesy of Spencer & Halstead Limited.)





(Courtesy of Spencer & Halstead Limited.)

FIG. 5.—*Miniature shotblast cabinet, with ejector gun.*

Automatic Plant

In the plants so far described, an operator directs the abrasive blast on to the various surfaces. This is a tedious process for small and intricate parts which can often better be treated *en masse*, being passed repeatedly through the blast from one or more nozzles until all surfaces are clean.

Barrel Plant.

Barrel-type plant is probably the oldest type of automatic plant; it resembles the tumbler barrel in that the parts are loaded into and treated in a barrel, either round or polygonal in cross section, the barrel being rotated quite slowly (usually about two r.p.m.) whilst the blast is played on to the bed of parts through holes in one or both ends of the barrel. Small barrels may be overhung from a shaft and supported on a pair of rollers, the blast—a single one in this instance—being introduced at the far end through a central hole; larger barrels are supported on and driven by rollers (two pairs) and have the blast introduced at one or both ends. They are either made of perforated plate so as to pass the spent abrasive, or of solid plates with gaps between them through which the abrasive, but not the material being treated, is discharged. Barrels are housed in a cabinet, with collecting hopper, pressure chamber, etc., as for other types of plant. Owing to their simplicity and the ease with which the bearings of the driving shafts may be placed well away from the blasting zone, they are a most suitable type of plant for small and medium-size castings.

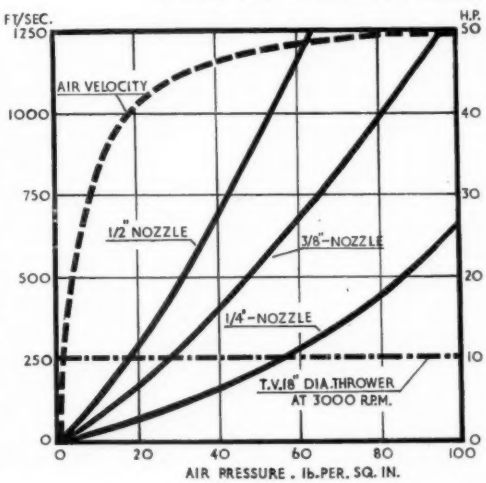
Rotary Table Plant.

The rotary-table unit may be described as a cabinet, semi-circular in plan view, the floor being part of a circlular table on which parts are loaded outside and then carried through the cabinet and into the blasting area of one or more nozzles. Multiple rubber flaps are provided at the front of the cabinet and the parts push their way in and out through these as the table rotates, usually at one to two r.p.m., the drive being by a geared motor connected to the axle shaft of the table or through rollers on which the table rotates. The operator's duties are limited to turning the parts over in addition to loading and unloading the table, the parts making any desired number of passes through the cabinet till all surfaces are cleaned. In the smaller sizes of plant—those having a table of from five to eight feet dia.—one nozzle is used. Two or three are adopted in the larger sizes—up to 12-ft. dia.—and the nozzle or nozzles are rocked or moved in a rotary way to assist in covering as great an area as may be required. Since vertical surfaces necessarily receive less-effective treatment than horizontal ones, this type of plant is particularly suitable for flat parts, such as gas-stove components.

Two variations of this type of plant may be mentioned. One is where subsidiary rotating "planet" tables are carried on the main table so that the parts "waltz" round as they pass through the blasting zone. This complicates the driving mechanism somewhat but gives more complete cleaning of difficult-shaped parts. The second variant is the "half-

FIG. 6.—*Velocity and power requirements for nozzles of various sizes compared with a centrifugal thrower.*

(Courtesy of H. G. Sommerfield Limited.)



Cleaning of Castings

in, half-out" rotary table (Fig. 4)—cabinet or room again having its floor formed of half of a circular table but in this case some castings are blasted on one half of the stationary table whilst others are being loaded on to the other half by a labourer outside. On completion of the work on the one half, the table is given half a turn and the new batch enters the cabinet for treatment, the first batch being simultaneously off-loaded. A vertical partition on the centre-line of the table seals off the opening in both operating positions. Again, planetary rotating tables may be used, in conjunction with the "half-in, half-out" table, and, of course, the blasting may be carried out under manual control—from outside in the case of the cabinet, by an operator working inside in the case of a room.

Conveyor Plant

In the case of conveyor plants, parts are carried through a cabinet or room by a belt, roller, or pendulum conveyor. Except in the rare cases when one pass through the blasting zone will suffice for the abrasive to reach all the required surfaces, the conveyor is generally made reversible so that the parts may be passed backwards and forwards as many times as necessary. When the volume of work justifies it, a good arrangement is two or more such plants running in tandem, with turning over stations between them. Uni-directional working, well suited to mass production, is thus achieved. As for the rotary table, single or multiple nozzles may be used along with automatic operation of the blast.

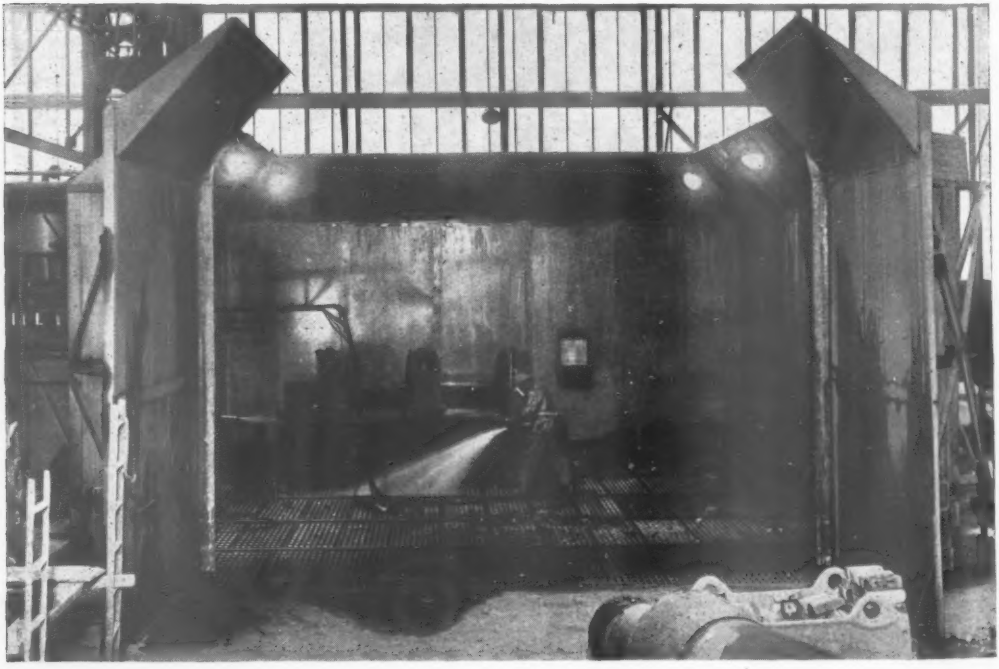
Special Plant

In addition to these various standard types of plant, machines are designed for special purposes in many forms, manually controlled or automatically operated according to requirements and usually "ringing the changes" on the types already described. A good example of a specialized plant is that designed for treating all surfaces of baths in one pass, necessitating six or eight nozzles all oscillating in different ways. In general, however, castings, as distinct from semi-finished parts, can best be handled in standard types of plant.

Ejector Gun

The plants so far described have all been based on the pressure chamber-hose-nozzle system of working. An alternative air-operated system (Fig. 5) is that in which the expansion of the air through a venturi is used to give an ejector action to draw abrasive into the air stream, the resultant abrasive blast being used in the same manner as for that from the normal nozzle. The blasting effect is, however, very much less than that obtained with "direct blast" under the same pressure of air and

FIG. 7.—*Hydroblast room plant with the operator working inside.*
(Courtesy of Harland and Wolff Limited and Pneulec Limited.)



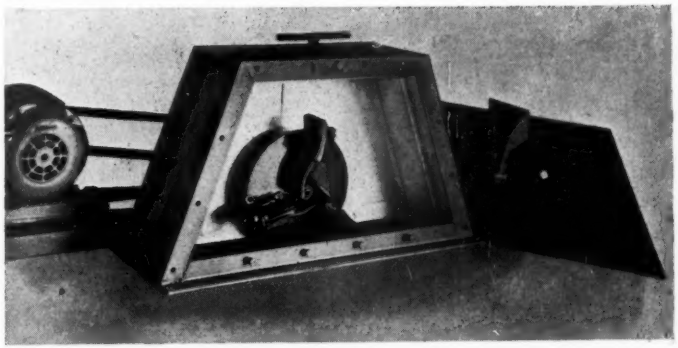


FIG. 8.—*"Bombardier" centrifugal "shotting" unit.*
(Courtesy of H. G. Sommerfield Limited.)

such apparatus is mainly restricted to very light work and small plants. It is sometimes sufficiently vigorous for small non-ferrous (particularly aluminium and Mazak) castings and is certainly a very economical type of plant both in first cost and running expenses.

Power Consumption of Air-operated Plant

Before leaving the subject of air-operated plant, the opportunity is taken of considering compressed-air requirements. The curves in Fig. 6 show the horse-power required to supply compressed air at different pressures to three common sizes of nozzle, together with the resultant air velocities (which are, of course, independent of nozzle size). It will be noted that the air-velocity curve rises steeply at first, but levels-out at about 20 lb. per sq. in. and only increases by a further 20 per cent. or so up to 100 lb. per sq. in. The horse-power curves on the other hand rise with increasing steepness as pressure is increased. In practice, blasting of non-ferrous castings is usually done at 20 to 40 lb. per sq. in.; cast iron at 40 to 80 lb. per sq. in. and steel castings at 60 to 90 lb. per sq. in. It is fairly certain that the shot particles, which are only influenced by the high-speed air-jet in the nozzle for a very small fraction of a second, never reach anything like the velocity of the air, and the line showing the theoretical velocity of a particle discharged from a centrifugal shotting unit, as described later, is of interest in this connection.

Liquid Blasting

In its smaller form liquid blasting is probably of little interest in the cleaning of castings, since it is a process used when a very fine finish, involving an abrasive of up to grade 1,000 or finer (sieve mesh) which would be too dusty for air blast. The process is also known as "vapour blasting" and "liquid honing" and the blast is in the form of a suspension of the abrasive in a stream of atomized liquid (usually water) blown from a nozzle under high pressure. The abrading action is light compared with other methods not only because much of the energy is expended in producing the high velocity water-jet—which has no abrasive effect, of course—but also because the liquid appears to modify the action of the abrasive to some extent. Thus the process is used rather towards the finishing end of a manufacturing cycle rather than for primary cleaning of parts.

Hydroblast System

The Hydroblast system is a process evolved primarily for the purpose of removing the large quantities of core material involved in the production of certain types of heavy iron or steel castings. Early attempts to effect this removal by a high-pressure water-jet, as an alternative to the dusty, dry-process of removal, had only limited success. The Hydroblast (Fig. 7), however, uses a high-pressure jet of water with which is mixed a

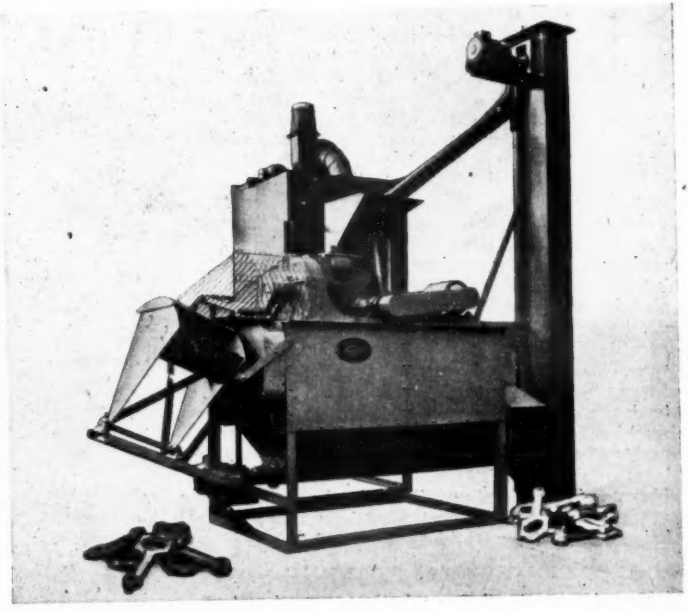


FIG. 9.—*"Scarifier" continuous "shotting" machine.*
(Courtesy of Spencer & Halstead Ltd.)

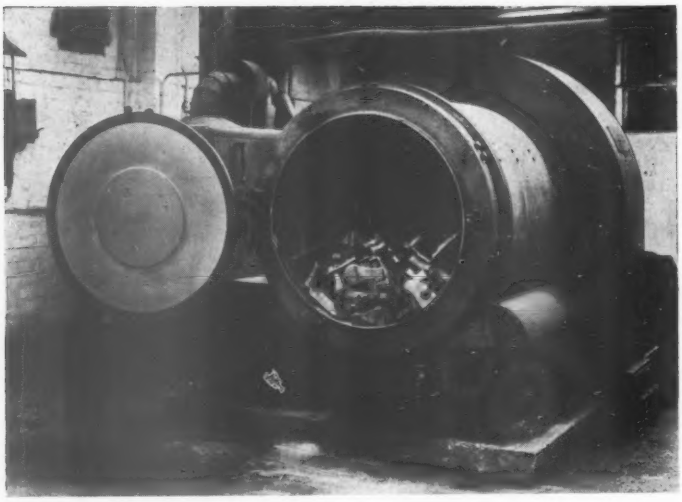


FIG. 10.—*"Centriblast" barrel-type "shotting" plant.*

proportion of sand; pressures up to 2,000 lb. per sq. in are used, which, it is of interest to note, give a water velocity comparable with the abrasive velocity obtained with the dry-blasting methods. The operator works inside a room which much resembles a shotblast room, except that, there being no dust, the roof may be left open. The latter is convenient for the crane handling of large parts. Alternatively, the operator may work from outside the room and direct the "gun" and observe the work through a sight glass, as for a shotblast cabinet. The core-sand and that in the water-jet together form a sludge which falls through the grid floor, along with much of the reinforcing ironmongery of the core.

In most plants these materials are not wasted; the irons are screened out for possible re-use and the sand is washed and classified, a proportion being used for introduction into the water jet, some being suitable for re-use as core sand, and only the finest silt, etc., being discarded. This reclamation of material, whilst not of immediate interest from the point of view of the cleaning of castings, and adding to the cost of the plant, can provide important savings. However, a simplified unit is now being introduced in which the bare essentials only for wet cleaning are incorporated. The power requirements of the Hydroblast are similar to those of a comparable shotblast room—about 50 h.p. per operator. The quantity of water used is 25 gall. per min. for an operator working inside and this gives a back pressure on the gun of 35 lb. For an operator working from outside, where the swivelling arrangements of the gun can take the thrust of the gun, a larger unit using 50 gall. per min. may be used. If water is not freely available in these quantities, a water-reclamation plant may be used. the cost being of the order of 4d. to 6d. per 1,000 gall.

CENTRIFUGAL SHOTTING

Centrifugal shotting, as indicated earlier, is by far the most important alternative to air-operated blast, which it has in many directions entirely superseded. Due, however, to its limitations in certain directions there must always be a considerable field in which the earlier methods will continue to be required.

In essence, the abrasive thrower (Fig. 8) resembles a paddle-blade centrifugal fan in which the abrasive is fed to the eye of the runner, and thrown out at the periphery of the blades. However, whereas air can be collected in the volute chamber of a fan and discharged through an outlet in any required direction, no such collection of the abrasive can be carried out, due to the absorption of shotting energy and inordinate wear to which any such collecting device would give rise, and the abrasive stream must be used as discharged by the runner. Therefore, unlike the blast from a nozzle, which is very concentrated and directional, the abrasive tends to be discharged all around the periphery of the runner. If parts to be cleaned could be arranged around such a runner this

FIG. 11.—*Rotary-table "shotting" plant.*
(Courtesy of H. G. Sommerfield Limited.)

feature would not matter, but generally it is required to handle the parts in much the same sort of way as has been described for air-operated plants. Many means have been tried to evolve a way of feeding the abrasive into the runner in such manner that it gets discharged over only a limited arc of the periphery, and in practice one can arrange that this arc is of the order of 90 deg. so far as the intense shotting stream is concerned, tailing off to a weaker effect beyond the limits of this arc. Measures must be taken to prevent the unwanted part of the discharge from causing damage, these usually taking the form of a cowling, partially enclosing the runner and provided with wearing plates of easily-renewable, hard-wearing material. A point of interest is that the arc of discharge lies on the opposite side of the axis of the runner to the point at which the abrasive is fed into the blades. If, therefore, as often happens, a downward shotting effect is required—for example, to operate the rotating table type of machine—the abrasive must be fed to the runner above its axis of rotation, and it is not easy to do this satisfactorily. However, the problem has been solved and runners are arranged to give their shotting effect downwards, horizontally or upwards as required. It will be remembered that it was mentioned that with some types of air-operated plant the nozzles have to be oscillated to give the required coverage; the spread of centrifugal shotting can generally be used to give all the coverage required. An example of a continuous shotting machine is shown in Fig. 9.

Whereas air, even when conveying dust and chips (as in pneumatic conveyors) can pass through a fan without causing serious wear of the impellor, to provide blades that will accelerate shotting abrasive is a very different matter and the wear of these blades was at first, and sometimes still is, a serious factor in operating this type of plant. Long blade-life is not only a question of providing hard-wearing material for the blade, the abrasive must be fed to or near the root of the blades without shock, even though the speed of rotation may be 3,000 r.p.m. or thereabouts and kept in contact with the blade without bounce until it is discharged with a velocity of several hundred feet per second about $\frac{1}{1000}$th sec. later—representing an average acceleration of about 1,000 g. Small wonder, therefore, that some shotting machines not only wear their blades out in a few hours but also break up the abrasive much more rapidly than the air-operated nozzle, in which the particles are accelerated by air pressure only.

Power Saving

Here the greatest inherent advantage of this type of machine must be mentioned, namely, its great saving of power as compared with the compressed-air type. The power absorbed by the impeller varies from 5 to 12 or 14 h.p., depending upon design, rate of abrasive feed, speed, and so on, and the effect from such a unit should be as great as that using the power output from a 300-cub. ft. compressor taking 50 to 60 h.p. As regards first cost, that of the machine itself may be high, but not necessarily much higher, and possibly lower, than an air-operated machine plus compressor equipment with all ancillary gear—air receiver, water-cooling equipment, filters, and so on—and there is almost always a saving of space. Furthermore, the system lends itself to multiple-thrower designs, projecting abrasive towards the work from several directions at once, making for rapidity of throughput and complete coverage of work. Maintenance charges tend to be heavy, as wear of both the blades and of the other parts of the machine that the abrasive reaches necessitates frequent renewal of parts, but one may judge from the great success that these machines have enjoyed that this may be more than counterbalanced by the saving in power and other factors.

Another point to be noted is that centrifugal shotting is only applicable to automatic plant. In point of fact, the first Patent of which the Author has a record covers a runner with flexible drive-shaft, fed through a flexible hose, intended to be held in the hand like a portable grinder and used like a nozzle. It is conjectured that the patentee had not seen, or heard, a blade break—giving an effect rather like the bursting of a small bomb, as the flying fragments cause the other blades to follow suit—or yet felt the immediate and violent out-of-balance running of the unit resulting therefrom. He would indeed be a hero who would venture to use such a device, or even manipulate parts in a cabinet provided with anything of this nature. Certainly, it is for the equivalent of the barrel plant (Fig. 10), the rotary table (Fig. 11), and the conveyor type of machine that the centrifugal shotter is suitable; given this limitation it has a very wide field of application. It will doubtless be understood that the spent abrasive has to be collected after use and returned to a storage hopper, usually by an elevator, whence it is passed through an adjustable feed, with a cut-off back to the impellor. Dust extraction is just as essential a part of the equipment as with air-operated plant.

Types of Abrasive

Except in the Hydroblast system, angular metallic grit is almost always used as the abrasive today. It is made by causing a fine stream of molten iron from a cupola to fall into cold water, the stream usually being broken up by jets of water or of steam. The resultant material solidifies in the form of thoroughly chilled peas or beans and these are dried, crushed, and graded for size. Ideally, all the resultant particles should be sharp cornered grains of a hardness and toughness such that after so many passages through the shotblast cycle, when the sharp corners are becoming dull, they will fracture and reveal fresh cutting edges. Finally, they will be pulverized to a dust and be withdrawn by the dust-extraction plant. The range of grades of abrasive, *i.e.*, particle sizes, in common use covers about a dozen screen meshes between 8 and 100, or so, per in.

It is sometimes desired to clean a casting without removing the "skin," as would be done by angular

abrasive, and in this case "round shot" is used. This is the above material screened out between the drying and crushing stages. Since the cleaning action of shot is due to a battering rather than cutting action of the particles, the effect of blasting with shot is rather slower than with the angular type. The round particles ultimately break down and reveal cutting edges so that in practice the process is not wholly free from a cutting action.

In cases where angular metallic grit cannot be used—for example in certain classes of aluminium castings—a non-ferrous silica-free material which may be thought of as a synthetic "sand" is usually employed, but there are available a few natural minerals, such as pulverized rocks which are also suitable. The synthetic "sands" are mostly of the carborundum type, the cheapest grades arising from pulverized scrap grinding-wheel material, and the best being specially made granular material.

Such material is available over much the same range of sieve-mesh sizes as metallic grit, plus very much finer sizes for use in the liquid blasting process, where metallic abrasive is clearly undesirable.

A further abrasive has recently become available, although it is not of much interest to foundrymen. It is made from alloy-steel wire by chopping off lengths about equal to its diameter, so that the particles look like miniature roller bearings. Abrasive made in this way can be produced over a wide range of ductility, toughness and so on, to suit individual circumstances and since the particles will probably be nothing like so brittle as those made of chilled iron they will have a much longer life—that is, the period before they are reduced in size to the point of dust. The cost of abrasive produced in this way is from five to ten times that of the usual metallic grit, but its life is claimed to be from 10 to 20 times as great. It will, however, not have the cutting power of grit, and is chiefly useful for peening rather than cleaning purposes.

Nozzles, Hoses and other Materials

Various materials have from time to time been used for the nozzles of air-operated plant, these varying in the bore from $\frac{3}{16}$ in. to $\frac{1}{2}$ in. dia. or more. Chilled iron, white iron, and alloy iron have all been used with varying success, a well-designed white-iron nozzle costing a shilling or so and being good for 20 or 30 hours' use. The modern tendency is to use hard metal, a lining of, for example, tungsten carbide being carried in a steel or other sheath and giving a working life of perhaps 2,000 hours—and costing nearly as many pounds as the others do pence. A recent development is the ceramic nozzle, with a life and price about 10 times those of the iron nozzle, and it appears that ceramic materials are being rapidly improved as regards wearing qualities, so that in terms of cost per hour of wear they are coming to be attractive.

For flexible hoses a rubber-canvas structure is invariably used (usually three- to five-ply canvas which is safe up to an operating pressure of 100 lb. per sq. in.), with a lining about $\frac{3}{16}$ in. thick of shot-blast-quality rubber to give a good smooth bore, and a thin (usually $\frac{1}{16}$ in.) outer "friction" layer of rubber to guard against chafe. The diameter of the rubber hose is large compared with that of the nozzle—it should be such that the abrasive is satisfactorily conveyed by the air stream, but not so small that undue wear is caused by high velocity. Provided abrupt bends are obviated, the hose has a surprisingly long life—measured in months rather than weeks. Difficulty arises at times through static electricity generated by the air and abrasive friction in the hose; for this reason a wire embedded in the rubber is used to earth the nozzle and its holder to the body of the machine; alternatively one of the "conducting" rubbers may be used for the lining, this being a rubber with additives designed to make it a conductor of static electricity.

For the protection of local surfaces from intense wear, *e.g.*, the walls of cabinet plants and the housings of centrifugal impellers, either cast-iron or alloy wearing plates may be used, or in many cases rubber sheeting is suitable. If the latter can be hung freely rather than bonded to a metal panel, it will give very good service, a rubber lining $\frac{1}{8}$ in. thick giving a longer life than steel plating $\frac{1}{4}$ in. thick.

As regards the throwing blades of centrifugal impellers where wear is, as has been mentioned, a severe problem, makers are rather shy of divulging details of their materials. White-iron castings and alloy irons, particularly of the Ni-Hard type, have been largely used; blade lives of between 50 and 100 hours are now obtainable. Uniformity of structure is important, since if one blade wears more rapidly than the others out-of-balance running will necessitate immediate replacement of the whole set of blades if bearing damage and possibly other troubles are to be avoided.

Legal Requirements

The use of shotblasting plant is covered by the Blasting (Castings and Other Articles) Special Regulations 1949 (S.R. & I. 1949/2225). This prohibits the use of sand or other substances containing free silica for all shotblast plants; when the plants are used with the cleaning of castings many additional safeguards are necessary—the blasting must be done in an enclosure, provision must be made for withdrawing dust from the abrasive, protective equipment and storage lockers therefore must be provided, the plant must be inspected by a "competent person" weekly and its ventilating plant inspected and reported upon monthly. No "young person" may be employed in or within 20 ft. of a blasting enclosure. It may be noted however that an Inspector of Factories is empowered to grant exemption from one or more of the requirements of the Regulations. Whilst so far as foundries are concerned it is believed to be unlikely that any general exemption would be granted, this might be done in isolated circumstances, such as, for example, in the case of a single out-size casting, too big for treatment in an existing cabinet or room; permission might then be given for the

cleaning to be carried out in the open air, and since most of the abrasive would then be irrecoverable, for sand to be used instead of shot.

Dust-extraction Equipment

Dust extraction is such an essential and important adjunct to any shotblast plant that brief mention must be made of the general features of plant used. The requirements are for equipment that will, first, maintain a pressure within the blasting enclosure a little below atmospheric, so that leakages through such orifices as armholes and loading chutes will be leakages of clean air inwards and not of dusty air outwards—and in view of the intense turbulence set up by the blast this is not by any means easy to ensure. Secondly, ventilation plant must, in the case of manually-operated plant, maintain an atmosphere clean enough to enable the operator to see what he is doing at all times, and, thirdly, the plant must separate the dust from the abrasive, as required by the Regulations and as is obviously desirable from the operating point of view.

In practice, dust-extraction plant with a capacity for giving five to seven changes of atmosphere per min. is desirable for room-type plants; for cabinets 10 or 15 changes per min. are required, due to the turbulence induced by the blast and the relatively large volume of compressed air being fed into the cabinet. For automatic plant, if totally enclosed as for example the barrel or Wheelabrator, three changes per min. may suffice, whilst for automatic plant requiring large charging or discharging openings, such as the rotary table, a very high rate is necessary to induce an in-draught through these openings and prevent the escape of dust through the rubber flaps or other means provided to guard openings.

Separation of the dust from the abrasive is best carried out by passing this over a series of louvres or past a series of orifices through which a stream of air is induced into the exhaust system. If correctly arranged, the usable abrasive particles will fall clear into a hopper for re-use, whilst the fines and dust will be drawn off by the air stream. A suitable position to introduce such a cleaning device is above the hopper (and below the floor) of a cabinet plant or in the feed- or discharge-chute of an abrasive elevator, so that the abrasive is cleaned on every circuit. Alternatively, a separate abrasive cleaner through which the material is periodically shovelled may be used, but this will entail extra labour and a built-in device should be employed wherever possible.

Finally, the dust-extraction system must incorporate means for separating the dust from the air before the latter is discharged, even though this be outside the building. For this purpose, cyclone, fabric-screen, fabric-bag, water-wash, and electrostatic types of dust-arresters are used. These should be capable of arresting at least 95 per cent. of the dust before the air is discharged. Because of the residual dust, which will almost inevitably consist of the finest particles, this discharge should be to outside atmosphere and not within a building. Exhaust fans may be of the paddle-blade, multivane or propeller types, and should operate by suction on the clean side of the dust-arrester rather than between the shotblast plant and the dust-arrester. Otherwise, the highly-abrasive dust passing through the fan is liable to cause rapid wear of the blades.

Conclusion

It is not claimed that the foregoing is a comprehensive survey of the problem of the cleaning of castings. It is hoped, however, that the different aspects of what is regarded by some as an unpopular link in the chain of production processes have each been given due consideration.

United Steel's Executive

Changes are announced in the structure of the executive management of the United Steel Companies, Limited, following the appointment of two new directors, Lt.-Cdr. G. W. Wells and Lt.-Col. P. F. Benton-Jones. Mr. Gerald Steel, formerly managing director, becomes general managing director, and Mr. A. J. Peech, formerly deputy managing director, becomes deputy general managing director.

Mr. K. G. Lampson becomes managing director (sales), Lt.-Cdr. Wells managing director (engineering works), Lt.-Col. Benton-Jones (who is son of the chairman, Sir Walter Benton-Jones) managing director (mining and carbonization).

Lt.-Cdr. Wells will remain general manager of the Appleby-Frodingham Steel Company, but he will also be responsible to the general managing director for the following subsidiaries:—Distington Engineering Company, Limited; Yorkshire Engine Company, Limited; United Steel Structural Company, Limited.

Lt.-Col. Benton-Jones, as general managing director of the United Coke & Chemicals Company, Limited, is already responsible for the ore-mining branch, and has a general responsibility for the company's mining and carbonization interests.

Diesels in Demand

In the first nine months of 1954 exports of British Diesel-electric locomotives were nearly five times greater than during the corresponding period of 1953, according to the Federation of British Industries Review. Mr. Malcolm Logan, director of the British Internal Combustion Engine Manufacturers' Association, says that world demand seems likely to continue. While exports for the industry as a whole last year were some way short of the peak sales of 1952, some lost ground was recovered.

Experimental Diesel trains have been running in Lancashire on the Buxton-Stockport line, Bury and Bacup lines, and from Manchester to Oldham. Rail experts are reported to be satisfied and it is likely that more Diesels will be introduced to Manchester.

Last February, the British Transport Commission announced a £2,000,000 programme providing for Diesel railcars and in October the programme was increased to £3,000,000. They were first put into service in the West Riding of Yorkshire on July 14 and in their first three and a half months' operation eight two-coach units increased net receipts for the area by £10,500.

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Net Assets of Stewarts and Lloyds

Total group net assets of £59,300,000, against £53,500,000, are shown in the first balance-sheet to October 2, issued by Stewarts and Lloyds, Limited, since the £10,000,000 equity was resold to the public. Among fixed assets of £40,430,000 (£33,000,000), land, minerals, plant, etc., figure at a net book value of £36,100,000 (£28,750,000), after accumulated depreciation of £20,460,000 (£18,900,000). The working surplus amounts to £18,860,000, compared with £20,480,000 at October 3, 1953.

Stocks at £22,300,000 are some £100,000 below the previous year, while debtors are down from £15,700,000 to £15,400,000. With creditors up from £10,200,000 to £10,700,000, the cash balance has risen by about £1,000,000 to £2,700,000. The capital is supported by reserves aggregating £20,400,000 (£32,600,000), apart from which there is a sum of £7,100,000 (£7,800,000) set aside for future taxation. The group has capital commitments of approximately £4,400,000.

Italian Production Rises

Industrial production in Italy is reported to have risen by 11 per cent. during 1954. Final figures of steel output are not yet available, but it is known that 4,000,000 tons of steel were produced during the year. Raw steel output exceeded by 1,000,000 tons the level forecast in the original steel industry rehabilitation plan, and further expansion is expected this year.

Production of both aluminium and zinc is now twice that of 1938, but output of mercury and lead remains slightly below the pre-war peak.

Although last year witnessed a steady growth of output in a large part of the Italian engineering industry, some sectors of heavy engineering—particularly rolling stock—made a rather poor showing. The power industry is stated to be producing more than double its pre-war output.

AT DECEMBER 14, 1954, the official index figure, which measures changes in the average level of retail prices compared with the level at the base date, June 17, 1947 (taken as 100), was 145, the same figure as at November 16.

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Other records were achieved in the slabbing mill where output, at 596,139 tons, exceeded that for 1953 by 13,000 tons, and in the hot strip mill, which, with 772,206 tons, surpassed its previous best by 32,000 tons. In the cold mills, both the three-stand and five-stand mills rolled 11,000 tons more than in 1953, and the output of hot-dipped and electrolytic tinplate was 145,000 basis boxes more.

Net Assets of Stewarts and Lloyds

Total group net assets of £59,300,000, against £53,500,000, are shown in the first balance-sheet to October 2, issued by Stewarts and Lloyds, Limited, since the £10,000,000 equity was resold to the public. Among fixed assets of £40,430,000 (£33,000,000), land, minerals, plant, etc., figure at a net book value of £36,100,000 (£28,750,000), after accumulated depreciation of £20,460,000 (£18,900,000). The working surplus amounts to £18,860,000, compared with £20,480,000 at October 3, 1953.

Stocks at £22,300,000 are some £100,000 below the previous year, while debtors are down from £15,700,000 to £15,400,000. With creditors up from £10,200,000 to £10,700,000, the cash balance has risen by about £1,000,000 to £2,700,000. The capital is supported by reserves aggregating £20,400,000 (£32,600,000), apart from which there is a sum of £7,100,000 (£7,800,000) set aside for future taxation. The group has capital commitments of approximately £4,400,000.

Italian Production Rises

Industrial production in Italy is reported to have risen by 11 per cent. during 1954. Final figures of steel output are not yet available, but it is known that 4,000,000 tons of steel were produced during the year. Raw steel output exceeded by 1,000,000 tons the level forecast in the original steel industry rehabilitation plan, and further expansion is expected this year.

Production of both aluminium and zinc is now twice that of 1938, but output of mercury and lead remains slightly below the pre-war peak.

Although last year witnessed a steady growth of output in a large part of the Italian engineering industry, some sectors of heavy engineering—particularly rolling stock—made a rather poor showing. The power industry is stated to be producing more than double its pre-war output.

AT DECEMBER 14, 1954, the official index figure, which measures changes in the average level of retail prices compared with the level at the base date, June 17, 1947 (taken as 100), was 145, the same figure as at November 16.

Publications Received

Industrial Management—a Course of Lectures Given at Cambridge University for the Faculty Board of Engineering. Published by the United Steel Companies, Limited, 17, Westbourne Road, Sheffield, 10.

The reviewer strongly favours the traditional method of acquiring knowledge by systematic study initiated through attendance at courses of lectures. Thus we welcome this book as a serious and co-ordinated contribution to the subject, for much of the material one reads on the subject of management is in general platitudinous, embellished by bits of smart claptrap. In this book there are included seven lectures, all given by experienced executives. They cover: The Rôle of the Directing Authority in a Large Company; Production Management in an Integrated Iron & Steel Works; Administrative Controls in Management; Duties and Problems of the Chief Engineer in a Large Steel Works; Organization and Application of Research in Industry; Planned Development; Planning a Large Steel Works; Staffing a Steel Works, and Problems in Training—from the Apprentice to the Manager.

The lecture which deserves special commendation is that by Dr. Chesters, dealing with research. Nowhere has the reviewer read such a clear dissertation on just what a research organization can and should accomplish. The cost of pilot plants; the preparation of reports; whether or not to worry about patents, are all thoughtfully dealt with. A study of this one book will enable the reader to put aside for quite a long period the great volume of extraneous literature on the subject of management which reaches his desk.

Shaping the Future: A Review of Productivity in the Wrought Non-ferrous Metals Industry. Published by the British Productivity Council, 21, Tothill Street, London, S.W.1, price 1s. 6d.

The manufacture of non-ferrous metals—copper, zinc, and copper alloys—into wire, sheets, bars, strips and tubes, etc., gives employment to some 65,000 workers in about 90 firms, varying widely in size. While some half-a-dozen firms employ thousands, there are numerous small, often family, concerns with fewer than 100 workers apiece. Birmingham is the traditional centre of the industry. It is a key industry inasmuch as its semi-finished products are indispensable components of a wide variety of manufactures.

A conspicuous deterrent to productivity is the variety of products demanded by customers. "Even the largest and most progressive firms, which consider themselves as essentially standard-product works, seldom, in fact, produce more than 50 per cent. of their output in standard dimensions and alloys. The effects of the immense range of metals and sizes called for by customers can be seen most clearly in large concerns, where, side by side with impressive, automatic machinery of the most-up-to-date design relatively old-fashioned plant is still kept in operation to deal with 'specials'." Simplification and standardization offer a possible remedy.

The review states that "Productivity in the industry as a whole has never been statistically measured" and points to the difficulties involved. Nevertheless, a number of firms "have measured productivity, using yardsticks of varying accuracy." Some account of the reforms adopted is given in the usual Appendix, which deals with ten firms.

An Engineering Career: A brochure detailing an Apprenticeship Scheme. Issued by Dewrance & Company, Limited, Great Dover Street, London, S.E.1.

This well-known firm, operating works in London, Dumbarton and Hillington, first gives the reader the commercial set-up of the organization, by means of a map and a suitably illustrated list of overseas representatives. This is a good beginning, as the boy entering industry should know more about his employers than just who his foreman is, and in which shop he is to work. As this concern employs many different kinds of skills, no emphasis is placed on the foundry. A good impression is given of the scheme operated, enhanced by an appropriate selection of views of the various departments.

Iron and Steel Trades in 1954. Published by William Jacks & Company, Limited, Winchester House, Old Broad Street, London, E.C.2.

There is not much of a foundry flavour about this review, but from the iron and steel point of view it is both comprehensive and interesting. However, the "Press Extracts" contain a mention of the golfing activities of Mr. F. Arnold Wilson, who is so well known in foundry circles.

Directory of Welding and Fabricating Equipment, section 1, Metal Arc Welding Electrodes. Published by Louis Cassier & Company, Limited, Dorset House, Stamford Street, London, S.E.1. Price 3s. 9d., post free.

This is a most useful guide to those practising arc welding. The composition of each brand is supplemented by information on such matters as the recommended welding position for each electrode.

Tangyes' Centenary

The centenary of the foundation of Tangyes Limited, Smethwick, by five brothers who left their native Cornwall to find greater scope for their ambition and technical skill in the Midlands, will be celebrated in 1956 and in preparation for the commemorations, the firm's agents in all parts of the world are being asked to supply information about the applications of the products in the early years of the company. One of the questions is "What is the oldest Tangye equipment at work in your area?" Already there are many examples of products made over 60 years ago still in regular service. One of these is a steam pump which has been in continuous use since 1883 at the Chance and Hunt works of the Imperial Chemical Industries Limited at Oldbury.

Latin America's Potential Market

Within five years, Britain could quadruple her exports of capital goods to Latin America, said Mr. J. P. Ford, chairman of the Institute of Export, on returning to London after a 30,000-mile tour of 13 Latin-American countries, during which he met senior Ministers, state banking officials, and industrialists. Latin America's potential development was incalculable and British manufacturers must take advantage of this situation now, he declared. Tomorrow would be far too late.

British deliveries, which had been showing an improvement, were now falling off again, Mr. Ford went on. If we did not watch our step, we should not achieve this potential export target of £400,000,000 within the next five years.

Iron and Steel Roll Production

New Melting and Casting Shop at R. B. Tennent, Limited

When it was first established in 1857 by the grandfather of the present managing director, R. B. Tennent's was just another of the many small iron foundries which formed the major industry of Coatbridge, Scotland, and the surrounding areas in those days. From that small enterprise, the company has grown progressively to its present position as a leading partner in the group of companies known as the British Roll Makers' Corporation, which was formed in 1942 to improve and develop roll products.

A reference in the 1864 edition of Miller's " Rise and Fall of Coatbridge " indicates that even then Tennent's was recognized as a growing concern. The writer stated that Mr. Robert Tennent, the enterprising lessee of the foundry situated at the bottom of Buchanan Street, had expended upwards of £1,000 on extensions and rebuilding to enable him to meet the demand for heavier castings for machinery and other goods of a like description. The words " to meet the demands for heavier castings " were of prophetic significance, because it has been the readiness to meet this ever-recurring demand that has placed R. B. Tennent, Limited, in the position they occupy to-day. The main products of the early days were hammer faces, anvils and machinery castings for local ironworks, heater pipes with bends, pit rails, chairs and miscellaneous castings for mines and blast-furnace plants.

Transfer to Whifflet

In 1870, the works were transferred to the present site at Whifflet where a new foundry and machine-shop had been built. Equipped with two air-furnaces, in addition to cupolas, castings of much greater weight were possible. This facility proved to be of considerable importance, not only in the increased tonnage of castings but from the fact that it enabled the works to develop on the lines demanded by the changing conditions of the heavy industries.

It was, of course, during this period that the new methods of iron-refining, destined to have such an effect on the iron trades in Scotland, which were largely centred at Coatbridge, were being developed. With steel largely replacing iron following the invention of the Siemens open-hearth furnace in 1861, and later, in 1878, the discovery and application of the basic method of Thomas and Gilchrist, the year 1872 saw the first of the new steelworks in the district at Hallside, followed soon after by Glengarnock, Clydebridge, Colvilles, Lanarkshire, Clydesdale and Wishaw. The erection of new steelworks meant that more and heavier types of castings were required from the foundries. With their facilities for large tonnage, Tennent's were employed continuously in supplying these demands, particularly for mill equipment.

Concentration on Roll-making

Beginning in the " seventies " with rolls for the local iron works the manufacture of rolls soon became of increasing concern and by 1890 formed an important part of the total output of the foundry. Up to this time, ingot moulds, the other major items which required continuous replacement in the steel plants, were also produced, but their manufacture was then practically abandoned in favour of concentration on roll-making. With steel replacing iron for shipbuilding—the first steel ship's plate of local manufacture was rolled at Hallside in 1879—soft rolls were not suitable for steel plates, thus presenting a challenge to the local manufacturers. Then, as now, the apex of the rollmaker's art was the " chilled " roll which at that time was a Staffordshire monopoly.

In 1879, Mr. R. B. Tennent visited Germany and purchased from Gontermann-Peipers their patented method of chilled-roll moulding, and shortly afterwards began experiments in making large chilled rolls for the rolling of steel plates. Success did not come for many years, but chilled-plate rolls ultimately proved to be the foundation on which Tennent's reputation was established as rollmakers. In 1889, an additional foundry, with air-furnaces (the present offices and laboratories are now in this building) was built for the production of chilled rolls. Additional lathes for roll turning, built by Murray and Paterson, were also installed. By this time Tennent's were not only supplying rolls to Scottish plants but were also shipping them to a number of important English users such as Palmers of Jarrow; Dorman Long; Bowling, and Stockton ironworks. The successful development of chilled rolls was a long and tedious process and one which demanded a high price before even a measure of success was achieved. That a technique was established, which, in its essentials, remains even to-day the basis of good practice, speaks volumes for the practical skill of those old craftsmen who, without any advantage of academic training, had to rely entirely on their own observations and powers of deduction.

Introduction of Steel Castings

When, in 1900, R. B. Tennent's became a limited company, the building of another and larger foundry began. However, before completion, the partly-erected structure was blown down during a severe storm. It was reconstructed and this building still forms the main foundry, capable, even to-day, of handling the heaviest of roll castings—a tribute to the thought and foresight then shown. Air furnaces with a combined capacity of 100 tons supplied the iron for castings. By this time, Mr. John Tennent was assisting his father in the management, and he is credited with the next major development, the making of steel castings, which commenced in 1905. The pattern of steel development was closely similar to that which iron had followed. In the early days, general castings formed the bulk of output with few rolls; with time this changed until, to-day, production of rolls

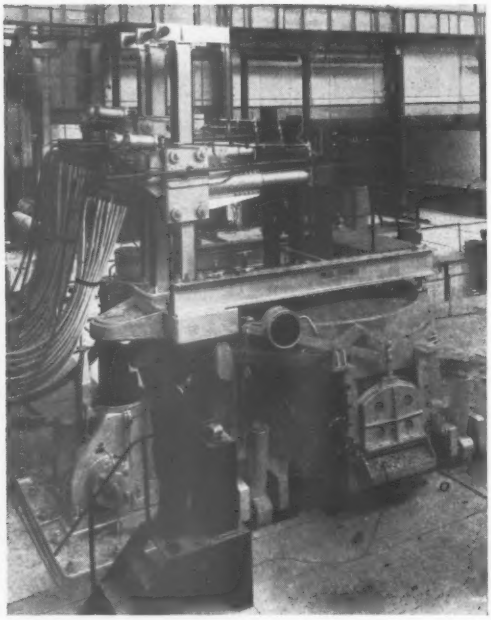


FIG. 1.—*Overhead view of the new electric furnace at R. B. Tennent, Limited, showing the arrangement of the electrode gear and roof-lifting mechanism.*

forms over 95 per cent. of the total output of steel castings.

The transfer in 1908 of the machine-tools to a new shop, now the roll-turning department, and the erection in 1909 of one more building, which became the heat-treatment and dressing shop, completed a programme which satisfied requirements of production for the next 25 years. In common with other industries, the works experienced the lean years of the twenties. That Tennent's were able, except for the 1926 strike, to keep in continuous operation, although on a much reduced scale, is a tribute to the reputation of the company and the quality of the products. The introduction of the specialized mill in the USA which has an electric drive, and the demand for even greater tonnage outputs has resulted virtually in a minor revolution in rollmaking and application in that country. The near stagnation in the home steel trade, however, made the introduction of such advances impracticable until there should be a revival in demand for steel products.

More-recent Expansion

In 1934, a programme of replacements and expansion was begun which continued until interrupted by war demands in 1940. During those years, the old lathes which were controlled manually, were replaced by modern precision machines with push-button control; new and improved types of machine-tools were added to meet the accuracy limits demanded of the electrically-driven rolling mill, in which a tolerance of plus or minus 0.001 to 0.002 in. is not unusual. The crane-carrying capacity was also increased and the casting plant was converted from iron to steel. In 1935, the manufacture of Adamite rolls began, under licence from the Mackintosh-Hemphill Company of Pittsburgh, USA.

In 1948 a further programme of development and expansion was undertaken to meet the ever-increasing demand for rolls throughout the world. Accordingly, the erection of new buildings for research, heat-treatment, machining, moulding and casting was begun.

The first phase called for extensions of the present heat-treatment and machining facilities and by 1950 two additional buildings had been completed. The installation of oil-fired heat-treatment furnaces, heavy-duty lathes and ancillary equipment was then undertaken, the majority of the tools being of Craven manufacture and incorporating the most up-to-date British designs in roll-machining equipment.

The second stage of this expansion programme was started in 1950 and completed this year. This newest extension consists of an additional foundry bay connected with the existing bays by an electric transfer car and complete with sand-handling, moulding, drying, melting, casting and annealing equipment.

New Electric Furnace

Noteworthy, in the new shop, is the arc melting furnace—a "Birlec" 12-ton model which is now in full operation. This furnace has a diameter of 12 ft. A top stiffening bezel ring, which is water-cooled, is provided to prevent distortion under heat. For slagging, oxygen lancing, fettling and other operations there is the usual refractory-lined door at the side and the pouring spout is on the opposite side. The roof is supported on a water-cooled channel-section ring, suspended at four points on two structural-steel beams, an arrangement which facilitates removal and replacement and obviates any trouble in aligning electrode ports and electrodes. The roof structure has an eye attachment in which a vertical hydraulic ram engages to lift the roof clear of the furnace for top-charging (Fig. 1). When the roof is raised clear of the furnace body, it is swung round through an angle of nearly 75 deg. thus fully exposing the hearth. Charging can then be effected by lowering a drop-bottom bucket into the shell (Fig. 2). These operations are effected by mechanisms which interlock to ensure that they take place in the correct sequence. Tilting of the furnace is effected by a pair of rams, the oil pressure for which, and for the roof-raising mechanism also, is generated in a self-contained electrically-driven plant.

Power for operating the furnace is obtained from the public mains on the three-phase system at 11,000 kv. through a metal-clad switch supplied by A. Reyrolle & Company, Limited, Hebburn-on-Tyne. This switch controls the supply to a 4,000-kva. transformer of Electric Construction

Company, Limited's, manufacture. The three 10-in. dia. electrodes are secured in water-cooled copper clamps—operated pneumatically by remote control—at the end of horizontal arms, which latter also support the electrical connections and the pipes carrying cooling water to the roof. At the other end, the horizontal arms are attached to crossheads, sliding on vertical steel masts. To these crossheads are fixed flexible steel cables, connected to individual winches for moving the electrodes up or down individually. The electrode winches are installed below the furnace floor and are provided with drums over which the cables pass and terminate in counterweights. Each winch is driven through gearing from a direct-current motor, the field of which is permanently excited at constant voltage. The speed and direction of movement depends on the magnitude and polarity of the output voltage of an Amplidyne unit for providing automatic adjustment of the electrodes, constructed by the British Thomson-Houston Company, Limited, Rugby. All the controls and metering equipment for the furnace are situated on a board on the wall of the transformer sub-station.

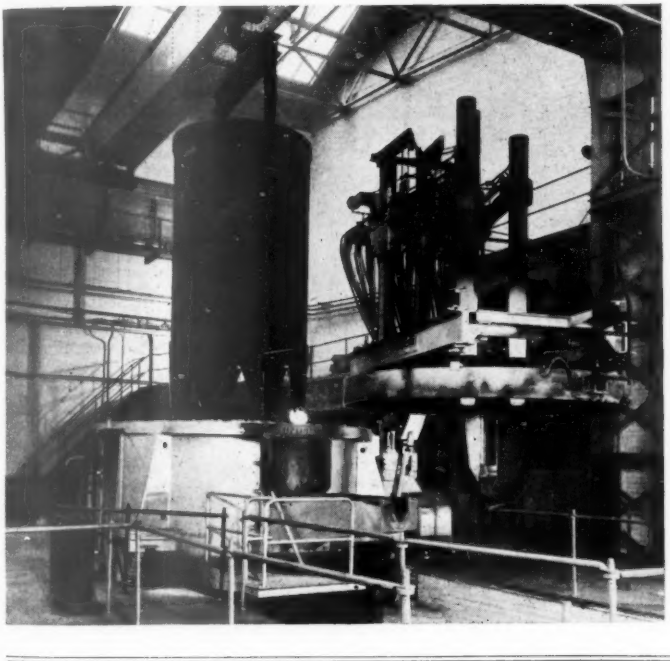


FIG. 2.—*Bucket charging of the electric furnace after the roof has been swung aside.*

It is worthy of mention that R. B. Tennent, Limited, have been working to capacity from 1938 to the present day, and are producing iron and steel rolls of all sizes and types to meet the requirements of the rolling mills at home and abroad. The range includes the large back-up rolls employed in the continuous-strip mills of Great Britain, France, Italy, South Africa and Australia. Considerable quantities of other types of rolls are exported also to these countries and to Southern Rhodesia, Canada, India, Turkey, Spain and Holland.

Midlands Industrial Development

Industrial development in the Midlands last year was almost double that of 1953 and in Birmingham alone an estimated £7 million worth of licences was issued for new factories or for extension of premises, Mr. Barry Kay, Regional Controller for the Board of Trade, told the Midland Regional Board for Industry on January 18. Mr. Kay said that during last year 417 industrial-development applications were received throughout the Midland Region, each involving more than 5,000 sq. ft. of factory space. For schemes involving building areas below this figure, development licences are not needed. The applications covered a total of 9,444,000 sq. ft., providing additional work for 9,973 people. In 1953, 247 applications were received covering 4,125,000 sq. ft. and work for 5,372 people. The space applied for by the vehicle industry in the region during 1954 was 46 per cent. of the total compared with 26 per cent. in 1953.

Although trade generally is still booming in the Midlands, shortages of certain types of steel and nickel alloy and the lengthening of delivery dates are causing some apprehension, it was stated. There had been a "sizeable increase" in the production of these materials but in spite of that fact, it had not been possible in all cases to keep pace with the increasing demand and some marginal shortages have resulted. The suspension of import duties on certain steel products recently announced would, it was hoped, go a long way to assist manufacturers.

Looking forward to "a real Midland effort in 1955" Mr. Kay said that the past year had ended with manufacturers convinced that the improvements in trade were firmly established and they were eager to maintain progress. "The increasing confidence in their ability both to produce and sell is very marked and is based on first-hand knowledge," Mr. Kay continued. "Industrialists and their senior executives learned much from the more-competitive and -exacting conditions of the past year or so and are more hopeful of success in facing up to overseas competition. The buoyancy of the home market has undoubtedly helped manufacturers with their export prices."

The Regional Board was also told of a further decrease in unemployment. Last month's figure of 9,376 for the area showed a fall of 1,095 on the previous month and was the lowest since September, 1951. The percentage of unemployment in the region was 0.5 of the insured population compared with 1.2 for the whole country.

University within Industry

The small number of grammar and public school boys entering industrial apprenticeship schemes is a common cause for complaint these days. It is interesting to note, therefore, that what is described as a "university within industry" is being started by the General Electric Company, Limited, in Birmingham this month. The first students at the "university" will be 60 18-year-old trainees, who will take a "sandwich course" lasting five years. At the end of that time the graduates will do their national service, and will return to civilian life fitted for important posts in the company's technical administrative and sales departments.

The course is described as a "sandwich" scheme because it gives trainees six-month periods of theory between similar periods of practical factory experience. The theoretical training will be supplied by the Birmingham College of Technology, where the trainees will work as full-time students. Throughout their training they will receive full apprenticeship wages. Entrants will be selected on personal qualities, but will be expected to show a fairly high academic standard.

The course will exempt trainees from examinations of certain professional bodies, such as the Institution of Electrical Engineers and the Institution of Mechanical Engineers. It is hoped that in about three years' time there will be between 250 and 300 GEC student trainees studying in Birmingham.

Lower Canadian Steel Output

Production of pig-iron in Canada during November dropped to 210,476 tons from 254,643 tons a year earlier. This brought the total for the first 11 months of 1954 to 2,027,799 tons, against 2,791,743 tons in the corresponding period of 1953. Steel-ingot output was also lower in November, at 282,110 (324,497) tons, and for January-November totalled 2,844,493 (3,713,468) tons. In November, output of steel castings fell to 5,063 (8,206) tons and for 11 months declined to 74,557 (96,571) tons.

During October production of iron castings and cast-iron pipes and fittings amounted to 61,100 tons, against 73,600 tons in October, 1953, and the 10 months' production was 595,300 (684,100) tons. Shipments during the month decreased to 46,900 (55,900) tons, and in the 10 months to 434,000 (489,800) tons.

Commodity imports into Canada from the UK during October declined to $31,520,000 from the $36,782,000 of the previous October. Imports from the UK for the first 10 months of 1954 were valued at $332,163,000, against $376,188,000. Part of the decrease for the 10 months' period occurred in iron products.

BISF Appointment

The new independent chairman of the Executive Committee of the British Iron and Steel Federation is Mr. R. P. Morison, QC, whose appointment was announced on January 18. He fills the place of the late Mr. Frederick Grant. The new chairman is the elder son of the late Lord Morison. He was educated at Winchester and at Edinburgh University.

Mr. Morison, who is 54, was called to the Scottish Bar in 1923 and to the English Bar in 1940. He took silk in 1936. Mr. Morison joined the Scots Guards in 1940 and became a maior and Deputy Judge Advocate in 1942. He was Sheriff of Inverness, Elgin, and Nairn, and Dean of the Faculty of Advocates in 1944-45. A member of the Industrial Disputes Tribunal since 1944, the new chairman has latterly been a Deputy Commissioner in Scotland under the National Insurance Acts.

Company News

COLTNESS HOLDINGS, LIMITED—The joint liquidators propose a further distribution of 15s. per share in cash. The distribution will be made to the members registered on January 14 and payment will be made on February 18.

WESTINGHOUSE BRAKE & SIGNAL COMPANY, LIMITED—A dividend of 18 per cent. is recommended by the board for the 53 weeks ended October 2, against 16 per cent. for the previous year to September 26, 1953. Trading profits of the group have reached a peak of £1,616,392.

VULCAN FOUNDRY, LIMITED—Negotiations are announced for the acquisition by the English Electric Company, Limited, of all the company's ordinary capital and that part of the capital held by the public of the subsidiary, Robert Stephenson & Hawthorns, Limited, locomotive builders, of Darlington, in which half the capital is held by the parent. Pending a further announcement, the company's ordinary holders and members of the public holding ordinary shares of the subsidiary are advised not to part with their holdings.

J. BROCKHOUSE & COMPANY, LIMITED—According to the chairman, Mr. J. L. Brockhouse, the supply of steel in all its forms was the company's greatest concern at present. Steel mills to-day were quoting nine to 12 months against specification. The worst feature was that even at this protracted delivery there was no guarantee of tonnage. It made rational planning of production an impossibility and the repercussions in the export market were very harmful. The publication of interim statements is also announced by the company.

LAURENCE SCOTT & ELECTROMOTORS, LIMITED—The company has a controlling interest in a new private company which has been registered with the title of Printing & Paper Drives, Limited, and an authorized capital of £20,000. The new company has taken over the sale of electric rotating machinery required for the printing and allied industries hitherto conducted by Meech Electric Drives, Limited, London, E.C.4. Mr. J. M. Simms has been appointed managing director of the new company, while Mr. J. R. Radington-Meech, of Meech Electric Drives, is also on the board.

ASSOCIATED ELECTRICAL INDUSTRIES, LIMITED—As previously forecast, the company offered seven AEI £1 ordinary shares in exchange for 10 £1 ordinary shares in Siemens Bros. & Company, Limited. The offer was conditional upon 90 per cent. acceptance not later than January 24 or such smaller percentage or later date as might be agreed between the two boards. Treasury consent has been obtained. At the same time a 10 per cent. final dividend is forecast by AEI to make 14 per cent. on £17,741,192 ordinary capital for 1954, against the equivalent to 11¼ per cent. paid for 1953.

LEY'S FOUNDRIES & ENGINEERING, LIMITED—The final ordinary dividend is maintained at 5 per cent. to make 11 per cent. with the paid interims for 1953-54. Production by Ley's Malleable Castings Company, Limited, of Blackheart and Lepaz malleable castings was maintained at the previous year's high level, although there was a decrease in demand for castings in the early part of 1954. Further substantial increases in the price of pig-iron, increased wages, and other costs caused some reduction in the profit margin. To have capacity to meet expected demand for its castings, a mechanized foundry is to be erected by Ley's Malleable Castings.

Staffordshire Iron and Steel Institute Dinner

Proposing the toast of "The Iron and Steel Trades" at the Staffordshire Iron and Steel Institute's 88th annual dinner at Wolverhampton on January 21, Viscount Chandos, former Colonial Secretary and present chairman of Associated Electrical Industries, Limited, said that the flow of technically-trained young men into the nation's industry, was falling sadly short of the required numbers and was causing industrialists considerable anxiety.

Viscount Chandos said the time had gone when young trained men should be encouraged to emigrate. The nation needed them and, indeed, would welcome Colonials trained in industry. "It is not often realized that this is a new country with a lot of new industries and that our power to create wealth in the world is being greatly accelerated," he said. "All these growing industries require technicians. It is no exaggeration to say that every industrialist engaged in large-scale business is anxious about the problem. It must be tackled by showing our boys and young men that there are modern opportunities awaiting those who will think in terms of the 20th century."

Sir Lincoln Evans, deputy chairman of the Iron and Steel Board, who replied to the toast, said that the Iron and Steel Board was not a body set up to impose the drag of public supervision on the thrust of private enterprise. "I like to think that in this country we are passing through a second industrial revolution," he said, "and because of that it is no good bringing out all the attitudes of mind of the first industrial revolution thinking they are applicable to the second." He added that the Iron and Steel Board was a product of the second industrial revolution. "Most people will accept that no basic industry, as iron and steel must be, can avoid being accountable to the nation as a whole for its commercial and industrial policies," he added. "The board," he said, "is the instrument through which the community is taking care to see that what is done in the industry shall conform to the vital needs and national requirements. We are something in the nature of an experiment, a new element in the structure of British industry which, if it is successful, may shape political thinking on public ownership for many years to come."

The toast of "The Staffordshire Iron and Steel Institute" was proposed by Viscount Cobham and the president of the Institute, Mr. K. G. Lewis, responded. Other speakers included Mr. A. Biddulph, senior vice-president of the Institute, and Canon A. Shepherd.

Board Changes

MILLSPAUGH, LIMITED—Mr. J. B. Thomas, chairman, is resigning from the board to reduce his business commitments.

FALKIRK IRON COMPANY, LIMITED—Mr. W. H. Smith, chairman and managing director, has been succeeded in the latter position by Mr. R. G. Sinclair.

E.G.B. (TOTTENHAM), LIMITED—Mr. J. M. Moody, Mr. J. Baron, and Mr. J. G. L. Bannerman have been appointed directors and Mr. M. Richards, Mr. A. E. Willis, and Mr. F. B. Lowe have retired from the board.

CHATWOOD SAFE & ENGINEERING COMPANY, LIMITED—Mr. Brian M. Sixsmith, managing director, is leaving the company. Control of the company has recently been purchased by the families of two former chairmen, the late Mr. John Hall and the late Mr. Ernest B. Hall.

Scotland's Heavy Industry

The tremendous confidence in the future of heavy industries in Scotland had been illustrated by the Colville flotation and the reopening of the Beardmore steelmaking plant at Linwood, said Mr. C. A. Oakley, industrial consultant and former Regional Controller of the Board of Trade in Scotland, when he proposed the toast of the Scottish Plant Owners' Association, at their dinner in Glasgow on January 20. Scotland's heavy industries, which had been blamed for the unemployment during the depression of the 1930s, had staged a most spectacular recovery, he said.

Although during his term as Scottish Controller of the Board of Trade, he had influenced light industries in coming to Scotland, he had served his apprenticeship in shipbuilding, and his affections naturally lay with the heavy industries. The depression, which had thrown idle something like a third of the working population, had led to the depressed areas being given particular attention, and because of that policy much of Scotland to-day had become a development area. Scotland's relatively small unemployment figure at present was due, he said, not so much to those light industries which had been established and which were employing 100,000 people, as to the heavy industries. The real factor in Scotland was that the heavy industries had not gone into a decline at the end of the war, but had remained prosperous. Mr. Oakley said he thought insufficient attention had been called to this aspect of the part heavy industry played in Scotland's prosperity. The heavy industries had done well by Scotland, and he hoped they would continue to do so for a long time.

Course on Foundry Working Conditions

The National Foundry College, in conjunction with the West Midlands Advisory Council for Technical Commercial and Art Education, are holding a short course of nine weekly lectures on Working Conditions in Foundries and the Requirements of the Factories Act, at the College, Wulfruna Street, Wolverhampton. The object of the course is to familiarize all grades of foundry staff and workers with the requirements of the related portions of the Factories Act in the light of recent legislation. There will be opportunities for discussion at each lecture meeting; all lectures begin at 6.30 p.m.

The first, held last week, dealt with hazards of foundrywork and the need for action, and was given by Mr. T. W. McCullough, OBE, BSc., HM Deputy Chief Inspector of Factories. This week "Dust and its Effect on the Lungs" was dealt with, and other lectures on successive Tuesdays will be concerned respectively with "General Health and Welfare Requirements of the Factories Acts with Special Reference to Foundries"; "General Safety Requirements"; "Special Regulations as to Blasting of Castings. Foundry Parting Materials. Grinding of Metals. Protection of Eyes"; "Iron and Steel Foundries Regulations, 1953"; "Exhaust Ventilation and the Behaviour of Dust"; "Attitude of the Trade Unions"; and "Problems from the Point of View of a Foundry Manager." The course tutor is Miss K. Crundwell, MA, HM Superintending Inspector of Factories, Wolverhampton.

SOME FORTY Danish agricultural engineers visited Huddersfield as the guests of David Brown Tractors (Engineering), Limited, of Meltham and Huddersfield; representatives of the firm met the visitors at Harwich.

Personal

General Sir DARIL WATSON, secretary general of the British Transport Commission, will be retiring in May, 1955, and Major-General LLEWELYN WANSBROUGH-JONES, CB, CBE, will take over.

Dr. C. J. DADSWELL, past-president of the Institute of British Foundrymen, has been appointed managing director of English Steel Spring Corporation, Limited, and Mr. W. C. MUIRHEAD becomes a director.

Mr. C. HAND has been appointed general manager of the Foundry Division of Sheepbridge Equipment, Limited. Mr. F. W. SIMMONS is now manager of the London branch of Sheepbridge Engine Repairs, Limited.

KEITH BLACKMAN, LIMITED, announce that MR. C. J. ATKINS has been appointed sales manager, with Mr. A. H. WOODLEY as his assistant. Mr. F. W. GOODGE is to be contracts manager and Mr. D. HUMPHREY assistant to the chief engineer.

Mr. FRED PICKWORTH, managing director of English Steel Corporation, Limited, Sheffield, is sailing to Australia this month to carry out a wide business tour, some of which will be carried out by air. Mrs. Pickworth is accompanying her husband.

AMONG EXPERTS GOING ABROAD under the Colombo Plan's technical co-operation scheme is Mr. WALLACE REDPATH, lecturer in the department of mechanical metallurgy at Paisley Technical College. He sailed for Burma on January 13 to take up an appointment as senior lecturer for the faculty of mechanical engineering of Rangoon University.

Sir EDWARD BOYLE, parliamentary secretary to the Ministry of Supply, made a two-day tour of Birmingham and Coventry firms in the motor and aircraft industries on January 12-13. In Coventry he visited Sir W. G. Armstrong Whitworth Aircraft, Limited, and Armstrong Siddeley Motors, Limited, as well as the Alvis factory. Among Birmingham firms visited was Joseph Lucas, Limited.

THE COUNCIL of the Institution of Mechanical Engineers have awarded the 1955 James Watt International Medal to Dr. IGOR IVAN SIKORSKY, of the United States, in recognition of his life's work in applying science to the progress of mechanical engineering through pioneering development of aircraft of various types; multi-engined, amphibians, and particularly helicopters. The James Watt International Medal was founded to commemorate the bi-centenary of the birth of James Watt—January 19, 1736.

Mr. JOSEPH WALTON, joint managing director of Thos. W. Ward, Sheffield, retires at the end of January. He will retain his position as chairman and managing director of the Darlington Railway Plant & Foundry Company, Limited, Darlington. He joined Ward's rail department as a youth in 1904, became a local director of the firm in 1927, a full director in 1937, and joint managing director in 1950. Under his direction the firm has built sidings at steelworks, collieries, docks and at electricity and gas works. His services will continue to be available to the firm in a consultative capacity.

THE DUKE OF EDINBURGH has become an honorary member of the Institution of Engineers & Shipbuilders in Scotland, the election taking place on January 11 at a general meeting in Glasgow. The Council of the Institution had been given permission to make the nomination. Under the constitution honorary membership is limited to twelve, but at present there are only three in addition to the Duke. The others are VISCOUNT WEIR OF EASTWOOD, elected in 1921, SIR HAROLD YARROW, BT., elected in 1941, and SIR MAURICE DENNY, BT., elected in 1950. Preparations are already being made for the celebration of the centenary of the Institution in the early summer of 1957.

W. H. Dorman & Company, Limited, of Stafford, announce that on the completion of his agreement on March 31, Mr. H. E. SMALLWOOD (over 30 years with the firm) will resign from his position as chairman and managing director, and will also relinquish his seat on the board. He will, however, continue to act as technical consultant to the company for a further period of years. Mr. G. C. SAUNDERS (42 years' service) will also resign his position as director and secretary. The directors have appointed Mr. DARBY HADDON as chairman as from April 1 next. Mr. J. W. WHIMPENNY, who is already on the board, will be appointed general manager. Mr. G. S. TUCKER, at present chief accountant and assistant secretary (associated with the company since 1925), will become secretary.

Obituary

Mr. GEORGE EDGINGTON, who was a former foundry manager at Markham & Company, Limited, Chesterfield, has died at the age of 73.

Mr. S. MACKENZIE STAFFORD, London-area representative of Thomas E. Gray & Company, Limited, of Kettering, died on January 3 at the age of 55. He had many years' service with this company.

THE DEATH is announced of Mr. GEORGE C. WALTON, sales manager of McKechnie Brothers, Limited, Birmingham. Previously Mr. Walton had for many years represented the firm in north-east England and in Scotland.

Mr. THOMAS WOOD, foundry foreman at the metal spun department of the Staveley Iron & Chemical Company, Limited, near Chesterfield, died recently at the age of 56. Mr. Wood had been associated with the company all his life.

THE DEATH HAS OCCURRED, at the age of 76, of Mr. THOMAS HENRY H. DAWSON, former head of the Keighley firm of Dawson, Bentley & Company, Limited, ironfounders and domestic-appliance manufacturers. Mr. Dawson retired five years ago.

AFTER A SHORT ILLNESS the death occurred on January 14 of Mr. DOUGLAS NOEL HAWTHORNE, of Wolverhampton, at the age of 64. Educated at Wolverhampton Grammar School and Wrekin College, Wellington, Salop, he had been associated with the Cannon Iron Foundries, Limited (now Cannon Holdings, Limited), Deepfields, Bilston, where his father was chairman and director for many years.

Mr. FREDERICK BOULDEN died in Morecambe Hospital at the age of 86. Mr. Boulden was the last member of the staff of the old Firth College, Sheffield, now Sheffield University. A Whitworth Scholar, he obtained degrees M.Eng. and M.Sc. (London) and was a member of the Institute of Mechanical Engineers. He was appointed lecturer at Firth College in 1889 and retired in 1932 after a distinguished career. He was marshal of the University for 11 years, past-president of the Association of University Teachers, a former member of the Committee of Convocation of the Northern Universities, and one of the founders of the Sheffield University Chronicle. He was also a founder member of the University Lodge of Freemasons, Sheffield, as well as a member of the Britannia Lodge, Sheffield.

News in Brief

BORO' LABORATORIES AND APPLIANCE COMPANY, LIMITED, 1, Station Buildings, Catford, London, S.E.6, are marketing the "Condenso" drip-regulator, having a working range of 2 to 180 drops per min.

PRESENTATIONS to two long-service employees were made at the Christmas party of the Storey Foundry Company, Limited, of Stockport, on January 8. The firm is only 35 years old, yet each of the men—who received gold watches from the company—has over 30 years' service to his credit.

THE NEW £50,000 FACTORY at Brownhills (Staffs) built by Fescol, Limited, was formally opened on January 12 by Mrs. F. B. Strachan, the wife of the company's assistant managing director. The firm is engaged in electro-deposition and the Brownhills factory has been built to complete a chain of installations.

DAVID BROWN CORPORATION (SALES), LIMITED, Penistone, near Sheffield, have produced a pocket-book detailing the mechanical properties of the various steels and bronzes which they manufacture in the form of castings. In addition, this useful booklet carries several pages of comparative data in tabular form.

A LONDON FIRM has recently been making borings in Northern Ireland for a substance known as perlite, from which can be processed a new insulating material which, it is understood, has been developed considerably in the United States. So far as is known, the County Antrim deposit is one of the few deposits of this mineral in Europe.

BY THE END of the year it is probable that a new 20-ton electric-arc furnace will be put into commission at the Sheffield works of Brown Bayley Steels, Limited. It will bring the total of electric-arc furnaces to four. The installation is part of the company's long-term expansion scheme. Under the project it is also proposed to expand the area of the open-hearth shop to twice its present size.

THE BRITISH INDUSTRIAL Measuring and Control Apparatus Manufacturers' Association held its annual luncheon on January 8. The guests included Sir Edward Boyle, M.P., Parliamentary Secretary to the Ministry of Supply and Sir Roger Duncalfe, president of the British Standards Institution. With a membership of 32 firms, the Association now commands the support of over 90 per cent. of the trade, it is claimed.

MORE THAN 450 PEOPLE were present at the Sheepbridge Engineering Limited, sixth annual ball, at the Victoria Ballroom, Chesterfield. Among those present were Mr. T. Brown (managing director, Sheepbridge Engineering Limited) and Mrs. Brown, and other leading officials of the company, including Mr. J. H. Lomas (managing director northern group), and Mrs. Lomas, and Mr. Z. Z. J. Kosarski (managing director, Midland group), and Mrs. Kosarski.

THE ANNUAL WORKS dinner of Stourvale Products, Limited, ironfounders, was held in the works canteen, and there some 50 employees were present. A toast to the firm was proposed by Mr. A. F. Webb, who gave a description of the firm's progress during his many years of service. He paid tribute to the chairman and managing director, Mr. J. Oakley, CC, under whose guidance it had prospered, but who very regrettably was unable to be present owing to illness.

A STEELWORKS at Linwood (Renfrewshire) which has been out of operation for four years is to resume production in the spring. It is a Ministry of Supply works and has been on a "care-and-maintenance" basis since December, 1950, under the supervision of William Beardmore & Company, Limited, Glasgow. The plant is expected to be producing steel in a small way before June, but subject to the Ministry's requirements the resumption will be confined to one electric furnace.

COVENTRY is planning to establish an industrial museum, and as a step in that direction the Lord Mayor and Lady Mayoress and members of the Libraries and Museum Committee visited Birmingham on January 21 to inspect the Industrial Museum there. Coventry already has a considerable collection of the products of its industries awaiting an appropriate home. They include the Bartleet collection of early cycles, some early motor-cars and products of the sewing-machine and watch and clock industries that once flourished there.

A REPRESENTATIVE of one well-known foundry-sand concern in this country reports that for economic mining and preparation of sands for shell-moulding larger tonnage outputs are necessary. He disclosed that although his firm is a major supplier of shell-moulding sand, it only produces 150 to 160 tons weekly compared with its production of ordinary foundry sand running at 10,000 to 12,000 tons per week. Figures comparing the tonnage or value of castings produced from the respective weekly tonnages of sand would indeed be interesting.

FOUNDED in 1947, the Spanish Iron and Steel Institute will hold its third general meeting this year. The institute is one of the organizations forming the Juan de la Cierva Foundation for Technical Research, and in the relatively short time it has been working it has actively conducted research work on iron and steel. The earlier general meetings of the institute were held in 1948 and 1951. For the third general meeting the plan has been adopted of holding sessions in different places, thus permitting visits to be made to some of the principal industrial establishments in Spain.

A HIGHLY SATISFACTORY training year was reported at the annual apprentice prizegiving of George Kent, Limited, at Luton, early this month, by Commander P.W. Kent, RN (retd.), chairman and managing director of the company. The number of apprentices in the firm's scheme is now 132. The main prizes presented were:—The Commander Kent challenge cup: E. F. Snare (on National Service); the Sir Walter Kent prize: D. Thirkell; the R. W. Bedford challenge cup: J. C. Keeling; and the Grout prize: I. R. Jepps. An exhibition depicting the work of the firm's apprentices was held in conjunction with the prizegiving, and aroused a great deal of interest.

J. L. WELLS & COMPANY, ironfounders, Wellington Street, Syston, Leics, have succeeded in their appeal to the Minister of Housing and Local Government against the refusal of Leicestershire County Council to give planning permission for the building of a workshop on land at Nelson Street, Syston. The Minister states that the needs of industry must be considered and a road proposed on a nearby building estate would cross what was a compact industrial site and could seriously affect the efficiency of the business. The company's Wellington Foundry was established in 1919 and the site for the proposed buildings comprises over two acres and adjoins the Wellington Foundry.

THE ANNUAL SPRING CONFERENCES in the Department of Industrial Metallurgy of the University of Birmingham will be held on March 14 to 15. The subject for the first day will be: "Graphitization in Cast Irons," and for the second: "Structure and Properties of Electrodeposited Metals and Alloys." At both conferences, papers will be given by eminent research men, reviewing the developments in the theoretical as well as in the applied fields, and will be followed by

News in Brief

discussions. For admission application should be made to the secretary, Department of Industrial Metallurgy, The University, Birmingham, 15, from whom full particulars of the programme may be obtained.

AMONG the members of a British trade mission which is to tour Egypt, the Sudan, and Ethiopia are Mr. A. W. Berry, director of the British Engineers' Association, Mr. A. E. J. Gawler, deputy overseas controller of Imperial Chemical Industries, Limited, Mr. Maurice Laing, managing director of John Laing & Son, Limited, civil engineers, etc., of London, N.W.7, Mr. T. A. L. Paton, a partner in Sir Alexander Gibb & Partners, consulting civil engineers, of London, S.W.1, Mr. J. F. Perry, managing director of Metropolitan-Vickers Electrical Export Company, Limited, and Col. R. E. M. Pratt, of the British Motor Corporation. The mission, which will leave London by air on January 29, will spend about a fortnight in Egypt and will visit Alexandria and Aswan as well as Cairo.

LAST WEEK, over 60 employees of Hartley's Malleable Fittings Company, Limited, of Halifax, completed a week's notice to finish work, and Halifax Employment Exchange stayed open until 7 p.m., with extra staff in an effort to find the men new jobs. Fifteen men turned up seeking jobs; it was expected that there would not be much difficulty in getting work, but due to the specialized nature of the trade, " stop-gap " jobs would have to be found for the men. It would not be possible for all the Hartley employees to move straight to another firm. A skeleton staff is being retained at the works to complete orders for pipe-fittings, but it is expected that they too will be seeking new employment in a matter of a few days.

COLOURFUL DETAILS of a 22,000-mile journey to the Indian sub-continent were described to an avid audience of younger-generation apprentices in the Day Continuation School of Leyland Motors Limited on January 12. The lecturer was Mr. C. S. Johnson, chief inspector at Leyland, and a member of the party of five Leyland officials who made an industrial advisory tour of India at the request of the Indian government during the last three months of 1954. Under the leadership of Mr. F. Grimshaw, Leyland's general works engineer, the party visited some 60 engineering concerns, travelling a total of more than 10,000 miles in the country itself. They also visited many of the leading Indian municipalities which operate Leyland vehicles, and spent some time at the assembly depots of the company's agents in Bombay and Madras.

ONE-HUNDRED-AND-EIGHTY-NINE young workers of the English Steel Corporation, Limited, Sheffield, were presented with prizes in connection with their further education courses by Mr. S. Moffett, Sheffield Director of Education, on January 14. The prize-money amounted to £1,140. Mr. Moffett told them that personality and experience are eventually more important than other qualifications. Mr. H. Parkin, education and training officer, said the firm's recruitment position was generally satisfactory. Some boys were applying for entry into the industry as much as six months before leaving school. He said that at one time 25 per cent. of the Corporation's youths who underwent National Service did not return to the firm, but to-day there was a vast improvement in this direction because of the closer touch maintained with those serving in the forces.

SHEEPBRIDGE ENGINEERING, LIMITED, announce that, by arrangement with Mahle-K.G., the sole UK manufacturing and selling rights for chrome-plating light-alloy engine-cylinders and similar components by a special process, have been secured. British van der Horst, Limited, a subsidiary of Sheepbridge Engineering, Limited, will operate this process, by which it is now possible to deposit hard chromium directly on to aluminium alloys. The selling rights secured under the agreement will be administered by Sheepbridge Stokes, Limited. Up to now, aluminium cylinders have had to be fitted with cast-iron or steel liners. The use of chromium-plated aluminium cylinders avoids a big difference in thermal expansion between piston and cylinder, provides an excellent wear-resisting surface, it is claimed, and one which is far more resistant to corrosion than cast iron, as well as greatly improving heat flow.

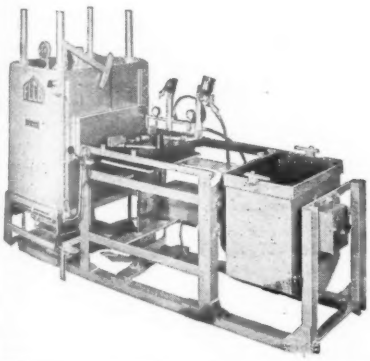
THE THIRD British Instrument Industries' Exhibition to be held at Earls Court, London, from June 28 to July 9, 1955, will be the largest of its kind. It will show the latest equipment of manufacturers of scientific and electrical instruments, industrial meters, automatic controls, scientific glassware, drawing office equipment, and their associated manufacturers. The organizers, F. W. Bridges & Sons, Limited, have made arrangements to cater for the needs of overseas visitors, and it is already apparent that large numbers will be attending. Concurrently with this exhibition there is the 10th International Printing Machinery & Allied Trades' Exhibition at Olympia (only a few hundred yards away), and in view of the rapidly growing importance of instrumentation to the printing industry, visitors will have the advantage of studying both modern printing machinery and the appropriate field of instrumentation, including temperature control.

A £430,700 CONTRACT for the construction of a new road bridge over the River Conway, South Wales, has been awarded to Sir William Arrol & Company, Limited, Glasgow. The cost of the new bridge, which will be free from tolls and will replace the bridge built by Thomas Telford in 1826, will be met by the Ministry of Transport. When completed in about two-and-a-half years, the new bridge will carry over the river the Chester-Bangor trunk road. It will have a single span of 310 ft. carried on four steel arch ribs. The bridge has been designed to harmonise with the background of Conway Castle and the medieval character of the town, and in these aspects it has the approval of the Royal Fine Arts Commission. The design is also suitable for widening at a later date if the growth of traffic makes this necessary. Since 1878 the present bridge has been in the custody of the Conway Bridge Commissioners. A toll is levied on vehicles using it.

THE YORKSHIRE COPPER WORKS, LIMITED, of Leeds, whose factory at Barrhead, near Glasgow, was opened in 1938, gave a luncheon in Glasgow on January 18 at which Provost Shanks, of Barrhead, spoke of the firm's expansion since then. He indicated that further expansion may take place, although the original output of the firm at Barrhead has now been increased threefold. Hitherto the product has been tubes, but future production is likely to include fittings as well. A film shown after the luncheon emphasized metallurgical research and the outlet for tubes in industry. Mr. H. F. Sherborne, manager and director of the firm, indicated that, apart from domestic goods, about 25 per cent. of the output goes into marine engineering, 20 per cent. into the generation of electricity, 15 per cent. into crude-oil refineries, and 20 per cent. into the food and transport industries. The colour film, " The Yorkshire Point of View." has been made for showing to engineers, shipbuilders, builders, and other tube users in Britain, and about 200 of these were present at the premiere on January 18.

SHELL MOULDING AT LOW COST

The Shelmolda 'Duplus' is low in first cost, economical to operate and costs little to maintain. Its design is simple and straightforward, yet it has the advantages of more complicated and costly apparatus. Operation is semi-automatic, with all the strenuous work carried out mechanically. The patent oven is thermostatically controlled and gives the machine a proved capacity of 50/60 moulds per hour. Pattern plates measure 24in. by 16in. and the maximum depth of pattern is 5in. Floor space required is 8ft. 6in. by 3ft. 3in. and the machine is operated by one man. Cost of the Shelmolda 'Duplus' is £575; delivery is 8 to 10 weeks.



Shelmolda

DUPLUS

PATENT APPLIED FOR

FAIRBAIRN LAWSON COMBE BARBOUR LTD

LEEDS, ENGLAND. Telephone : Leeds 32041

AP 236-73

Raw Material Markets

Iron and Steel

The severe weather in recent weeks has reduced the intake of raw materials and hampered the clearance of outputs. Blast-furnace operators, however, have reasonable stocks of ore and coke, and, in response to the rising requirements of the steelworks and foundries, hope to improve on the output figures for November and December, which for the first time exceeded an annual rate of 12,000,000 tons. Meanwhile, supplies of high-phosphorus iron barely meet the needs of the makers of light castings and the jobbing foundries, while hematite and irons with a low-phosphorus content are definitely in short supply. Small tonnages of pig-iron are still being licensed for export, but were the material available a much bigger foreign trade could develop.

It is a sign of the times that billets, bars, slabs, and rods are all on the list of duty-free imports. Re-rollers have no need to worry about outlets for all the material they can produce. Order-books are well filled to the end of the half year. But British steelworks have not been able to keep pace with the steep rise in the requirements of the re-rolling mills, and in some cases reserves of billets have been reduced to such small proportions that, unless they can be speedily replenished, full-scale operation of the small bar and light section mills may be interrupted.

Since the turn of the year there has not been the slightest relaxation of the pressure for deliveries of nearly all classes of finished steel. It is strongly suspected that the confident forecast of a boom year in steel, and the development on the Continent of conditions somewhat akin to those which have prevailed in this country during the past four months, have prompted many consumers to buy, or to seek to buy, in excess of their requirements. It is difficult for producers to differentiate. All that they can do is to speed up outputs, and perhaps to deal sympathetically with customers whose needs are most urgent. Many orders, however, are merely placed on the waiting list and consumers are now more urgently exploring the possibility of acquiring supplies from the Continent.

Non-ferrous Metals

Trading was fairly brisk last week with an upward tendency in all metals. Copper made the best show, for at the close of business on Friday cash was £8 up and three months £6 15s. better. The scarcity of prompt metal continues, but there has been some increase in the tonnage of refined copper in LME official warehouses. Much more, however, will be needed to be rid of the objectionable backwardation which is preventing hedging on the market.

The scarcity of high-grade zinc continues and a backwardation of 30s. was in operation at the close of business on Friday. January was up £1 and April 12s. 6d. No change was seen in the US price of 11½ cents. Lead was steady and closed 10s. up for the current half month, but 5s. down for second half April. Tin registered little change, cash being £2 up at £689 and three months £5 better at £692. Stocks of tin in official warehouses were last reported at not much short of 2,000 tons, which explains the contango.

The copper ring is still suffering adverse criticism on account of the daily fluctuations and the price, which all agree is much too high. There is persistent talk that the level of 30 cents in the States will be broken by an advance to 33 cents or even higher. To such a change there is a certain amount of opposition, but there is a great deal of doubt surrounding the question.

Details of November activities in the UK have been published by the Bureau of Non-Ferrous Metal Statistics. Consumption of copper in November was 52,382 tons, of which 42,846 tons were refined, which compares with 53,319 tons and 40,664 tons, respectively, in October. Stocks of refined copper in the UK at November 30 were 61,673 tons, an increase of nearly 200 tons on the October figure. Total consumption for the 11 months to November 30 was 520.880 tons, compared with 404,270 tons in the corresponding period of 1953.

Stocks of zinc at the end of November were 51,226 tons, nearly 7,000 tons up on the October total of 44,611 tons. Consumption of all grades of zinc in November was 27.901 tons, of which 21.233 tons were virgin metal. In October the corresponding totals were 28,543 tons and 21,307 tons. In the 11 months to November 30, usage of zinc in all grades was 295,173 tons, compared with 242,481 tons in the corresponding period of 1953. Stocks of lead advanced from 22,269 tons at October 31 to 26,937 tons at the end of November. Consumption of lead in all forms in November was 30,142 tons, against 30,123 tons in October. For the 11 months last year usage was 306,631 tons, an advance of nearly 30,000 tons on the 1953 figure.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* January 20, £300 to £302; January 21, £300 to £301; January 24, £305 to £306; January 25, £313 to £314; January 26, £312 to £315.

Three Months: January 20, £284 to £284 10s.; January 21, £283 10s. to £284; January 24, £288 10s. to £289; January 25, £296 10s. to £297 10s.; January 26, £297 to £298.

TIN, Standard—*Cash:* January 20, £685 to £686; January 21, £690 to £691; January 24, £694 to £695; January 25, £705 to £707 10s.; January 26, £713 to £714.

Three Months: January 20, £688 10s. to £689; January 21, £693 to £694; January 24, £697 to £698; January 25, £708 to £709; January 26, £715 to £716.

ZINC—*Second half January:* January 20, £85 to £85 5s.; January 21, £85 5s. to £85 10s.; January 24, £85 15s. to £86; January 25, £86 15s. to £87; January 26, £88 10s. to £89.

Second half April: January 20, £83 15s. to £84; January 21, £83 15s. to £84; January 24, £84 5s. to £84 10s.; January 25, £85 5s. to £85 10s.; January 26, £87 to £87 10s.

LEAD—*Second half January:* January 20, £102 to £102 5s.; January 21, £102 12s. 6d. to £102 15s.; January 24, £103 to £103 5s.; January 25, £104 5s. to £104 10s.; January 26, £105 15s. to £106.

Second half April: January 20, £102 5s. to £102 10s.; January 21, £102 10s. to £102 15s.; January 24, £102 15s. to £103 5s.; January 25, £104 to £104 5s.; January 26, £104 15s. to £105.

Latest Foundry Statistics

According to the Council of Ironfoundry Associations, the number of persons employed in ironfoundries on November 27, 1954, was 141,398. This compares with 140,952 in October, 1954, and 141.278 on November 28, 1953. It is stated by the British Bureau of Non-Ferrous Metal Statistics that the production of copper-base castings in November, 1954, was 4,331 tons. The past eleven months gave a production of 55,189 tons as against 45,302 tons for the corresponding period of 1953.

EYRE Aluminium Alloy Ingots

ESCO Gunmetal and Phosphor Bronze Ingots

THE EYRE SMELTING CO. LTD.

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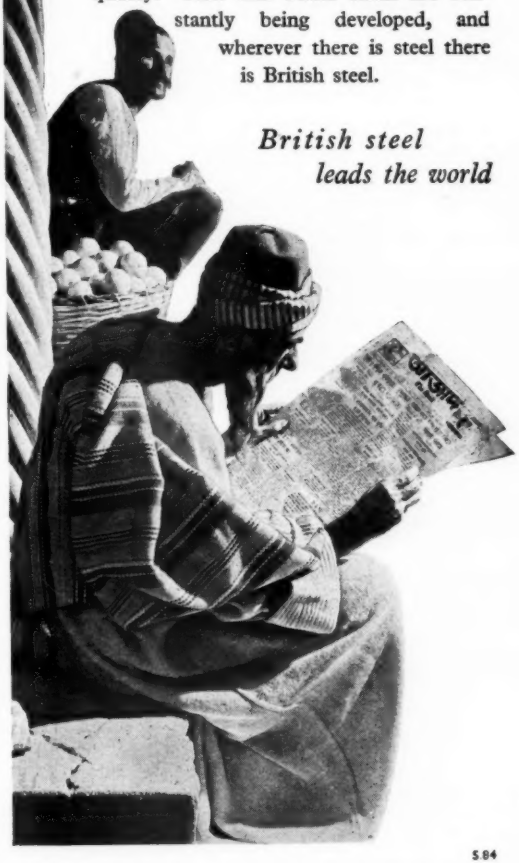
British steel leads the world



S 84

THE BRITISH IRON AND STEEL FEDERATION

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

January 26, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

Scotch Iron.—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

Basic Pig-iron.—£15 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s. 0d., basis 45 per cent. Si, scale 15s. per unit; 70/84 per cent., £63 0s. 0d., basis 75 per cent. Si, scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £185 0s. 0d. to £195 0s. 0d. per ton; 38/40 per cent., £251 0s. 0d. to £270 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 16s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 19s. 0d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C. £75 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £74 0s. 0d. to £76 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 7½d. per lb. Cr; 1 per cent. C,* 1s. 8d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. per lb. Cr; 0.10 per cent. C,* 1s. 9¾d. per lb. Cr; 0.06 per cent. C,* 1s. 10d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 6½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £54 15s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £54 10s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £54 7s. 9d.; nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

NON-FERROUS METALS

Copper.—Cash, £312 0s. 0d. to £315 0s. 0d.; three months, £297 0s. 0d. to £298 0s. 0d.; settlement, £300 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 34d. per lb.; wire, 330s. 3d. per cwt. basis; 20 s.w.g., 361s. 6d. per cwt.

Tin.—Cash, £713 0s. 0d. to £714 0s. 0d.; three months, £715 0s. 0d. to £716 0s. 0d.; settlement, £714 0s. 0d.

Zinc.—Second half January, £88 10s. 0d. to £89 0s. 0d.; second half April, £87 0s. 0d. to £87 10s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £116 5s. 0d.; rolled zinc (boiler plates), all English destinations, £114 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £98 0s. 0d.

Lead (Refined Pig).—Second half January, £105 15s. 0d. to £106 0s. 0d.; second half April, £104 15s. 0d. to £105 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 27⅜d. per lb.; rods, drawn, 36½d.; sheets to 10 w.g., 298s. 0d. per cwt.; wire, 34½d.; rolled metal, 284s. 3d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £1 92; B6 (85/15), £268; BS249, £210.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £235; HTB2 (30 tons), £242; HTB3 (48 tons), £259.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £253; LG3 (86/7/5/2), £261; G1 (88/10/2/½), £333; (88/10/2/1), £322.

Phosphor Bronze.—BS1400, PB1 (AID released), £345 per ton.

Phosphor Bronze Strip, etc.—Strip, 417s. 0d. per cwt.; sheets to 10 w.g., 439s. 6d. per cwt.; wire, 51¾d. per lb.; rods, 45d.; tubes, 43½d.; chill cast bars: solids 45d., cored 46d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 7½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 0¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 11¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £106 0s. 0d. to £109 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £163 0s. 0d.; aluminium bronze (BS1400), AB1, £302; AB2, £313. Solder, brazing, BS1845, 2s. 4d. lb.; granulated, 2s. 7d. lb.

* Average 68-70 per cent. Cr.